


The Ansys logo is positioned in the top left corner. It features a stylized yellow and white 'A' icon followed by the word 'Ansys' in a white, sans-serif font. The background behind the logo is a dark grey grid pattern.

Ansys

2019

ANNUAL
REPORT

A large, colorful 3D CAD model of a mechanical assembly, possibly an engine or a complex machine, is shown in a cutaway view. The model is rendered in various colors like green, blue, red, and yellow, highlighting different components. It is set against a dark background with a grid pattern. The model is positioned on the right side of the cover, partially overlapping a large yellow diagonal stripe.

50

YEARS OF INNOVATION

1970 - 2020



March 31, 2020

For the last 50 years, Ansys has made the world a better place through the power of engineering simulation.

Using Ansys simulation, customers are empowered to build products limited only by their imagination. They can speed products to market by easily validating design ideas, leading to revenue growth. Simulation amplifies research and development effectiveness and boosts efficiency, providing a bigger impact from a limited budget.

The Ansys value proposition is compelling to our customers. As a key driver of innovation in customers' research and development initiatives, Ansys simulation has repeatedly proven itself to be a key competitive differentiator. Whether they are developing 5G networks to vastly improve communications speed or electric vehicles to reduce our dependence on fossil fuels, companies across industries are using Ansys simulation to change the world.

Our importance to customers around the world is borne out by our strong financial returns. In our 2019 Annual Report, you will see that we continued to bring long term-value to our stockholders. Ansys' consolidated revenue was \$1.5 billion, an increase of 17% compared to 2018 and annual contract value was \$1.46 billion, a 10% increase. We reported GAAP diluted EPS of \$5.25, representing 8% growth and non-GAAP EPS of \$6.58, representing 10% growth. And our operating cash flow for the year was \$499.9 million.

As we face the uncertainties brought on by the current global health crisis, our mission feels more relevant today than at any point in our company's 50-year history. I am incredibly proud of Ansys' accomplishments. And I'm gratified – though not surprised – in how my colleagues at Ansys have responded to this crisis. Their resilience and ingenuity in the face of this challenge has been inspirational.

The diversity of the Ansys business model also helps ensure our resiliency during uncertain times like these. We have thousands of customers across multiple industries, including high-tech, aerospace, automotive and industrial. And we are well balanced across the geographies, with more than one-third of our business coming from the Americas and just under one-third coming from each of Europe and Asia. This diversity in our customer base means that we can harness growth from a wide variety of sources.

For the last 50 years, those customers have used Ansys simulation to help solve their most vexing product challenges. Those companies know that when it comes to their products, there cannot be any compromise. And they know that Ansys simulation will enable them to get it right the first time. And I am confident that Ansys will continue to be a valued partner, helping these leading companies continue to change our world well into the future.

That's a message we can all support right now.

Ajei S. Gopal - President and CEO

For more information regarding certain factors that could cause future results to differ, possibly materially, from historical performance or from those anticipated in forward-looking statements, see the Note About Forward-Looking Statements of our 2019 Form 10-K, which accompanies this letter. For additional information about non-GAAP financial information, including, reconciliations, see "Non-GAAP Results" in Item 7 of the accompanying 2019 Form 10-K.

**UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549
FORM 10-K**

(Mark One)

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

**For the fiscal year ended December 31, 2019
OR**

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

Commission File Number: 0-20853

ANSYS, Inc.

(Exact name of registrant as specified in its charter)

Delaware

(State or other jurisdiction of incorporation or organization)

2600 ANSYS Drive, Canonsburg, PA

(Address of Principal Executive Offices)

04-3219960

(I.R.S. Employer Identification No.)

15317

(Zip Code)

844-462-6797

(Registrant's telephone number, including area code)

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of exchange on which registered
Common Stock, \$0.01 par value per share	ANSYS	Nasdaq Stock Market LLC (Nasdaq Global Select Market)

Securities registered pursuant to section 12(g) of the Act:

None

(Title of class)

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or 15(d) of the Act. Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes No

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	<input checked="" type="checkbox"/>	Accelerated filer	<input type="checkbox"/>
Non-accelerated filer	<input type="checkbox"/>	Smaller reporting company	<input type="checkbox"/>
Emerging growth company	<input type="checkbox"/>		

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes No

The aggregate market value of the voting stock held by non-affiliates of the registrant, based upon the closing sale price per share of the registrant's common stock on June 28, 2019, as reported on the Nasdaq Global Select Market, was \$14,436,000,000.

The number of shares of the registrant's common stock, par value \$0.01 per share, outstanding as of February 20, 2020 was 85,914,375 shares.

Documents Incorporated By Reference:

Portions of the Proxy Statement for the registrant's 2020 Annual Meeting of Stockholders are incorporated by reference into Part III.

ANSYS, Inc.
ANNUAL REPORT ON FORM 10-K FOR FISCAL YEAR 2019
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Important Factors Regarding Future Results

Information provided by us in this Annual Report on Form 10-K may contain forward-looking statements concerning such matters as projected financial performance, market and industry segment growth, product development and commercialization, acquisitions or other aspects of future operations. Such statements, made pursuant to the safe harbor established by the securities laws, are based on the assumptions and expectations of management at the time such statements are made. We caution investors that our performance (and, therefore, any forward-looking statement) is subject to risks and uncertainties. Various important factors including, but not limited to, those discussed in Item 1A. Risk Factors, may cause our future results to differ materially from those projected in any forward-looking statement. All information presented is as of December 31, 2019, unless otherwise indicated.

Note About Forward-Looking Statements

The following discussion should be read in conjunction with the audited consolidated financial statements and notes thereto included elsewhere in this Annual Report on Form 10-K. Our discussion and analysis of our financial condition and results of operations in Part II, Item 7 of this Annual Report on Form 10-K are based upon our consolidated financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States of America (GAAP). The preparation of these financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenues and expenses, and related disclosure of contingent assets and liabilities. On an ongoing basis, we evaluate our estimates, including those related to fair values of stock awards, bad debts, contract revenue, acquired deferred revenue, the standalone selling prices of our products and services, the valuation of goodwill and other intangible assets, deferred compensation, income taxes, uncertain tax positions, tax valuation reserves, operating lease assets and liabilities, useful lives for depreciation and amortization, and contingencies and litigation. We base our estimates on historical experience, market experience, estimated future cash flows and various other assumptions that management believes are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates.

This Annual Report on Form 10-K contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934, including, but not limited to, the following statements, as well as statements that contain such words as "anticipates," "intends," "believes," "plans" and other similar expressions:

- Our intentions regarding our hybrid sales and distribution model.
- Our intentions related to investments in research and development, particularly as it relates to expanding the ease of use and capabilities of our broad portfolio of simulation software products.
- Our expectations regarding the accelerated development of new and innovative products to the marketplace while lowering design and engineering costs for customers as a result of our acquisitions.
- Our statements regarding the impact of global economic conditions.
- Our expectations regarding the outcome of our service tax audit cases.
- Our belief that, in most geographical locations, our facilities allow for sufficient space to support present and future foreseeable needs, including such expansion and growth as the business may require.
- Our expectation that we can renew existing facility leases as they expire or find alternative facilities without difficulty, as needed.
- Our assessment of the ultimate liabilities arising from various investigations, claims and legal proceedings.
- Our statements regarding the strength of the features, functionality and integrated multiphysics capabilities of our software products.
- Our belief that our overall performance is best measured by fiscal-year results rather than by quarterly results.
- Our estimates regarding the expected impact on reported revenue related to the acquisition accounting treatment of deferred revenue.
- Our expectation that we will continue to make targeted investments in our global sales and marketing organizations and our global business infrastructure to enhance and support our revenue-generating activities.

- Our intention to repatriate previously taxed earnings in excess of working capital needs and to reinvest all other earnings of our non-U.S. subsidiaries.
- Our plans related to future capital spending.
- The sufficiency of existing cash and cash equivalent balances to meet future working capital and capital expenditure requirements.
- Our belief that the best uses of our excess cash are to invest in the business, make payments on outstanding debt balances and repurchase stock in order to both offset dilution and return capital, in excess of our requirements, to stockholders with the goal of increasing stockholder value.
- Our intentions related to investments in complementary companies, products, services and technologies.
- Our expectation that changes in currency exchange rates will affect our financial position, results of operations and cash flows.
- Our expectations regarding future claims related to indemnification obligations.
- Our estimates regarding future stock-based compensation.
- Our expectations regarding the impacts of new accounting guidance.
- Our assessment of our ability to realize deferred tax assets.
- Our performance expectations related to our partnerships and strategic alliances.
- Our expectations regarding acquisitions and integrating such acquired companies to realize the benefits of cost reductions and other synergies relating thereto.
- Our statements regarding market opportunity, including the size and growth of addressable markets.

Forward-looking statements should not be unduly relied upon because they involve known and unknown risks, uncertainties and other factors, some of which are beyond our control. Our actual results could differ materially from those set forth in the forward-looking statements. Certain factors that might cause such a difference include risks and uncertainties detailed in Item 1A. Risk Factors.

PART I

ITEM 1. BUSINESS

ANSYS, Inc. (Ansys, we, us, our), a Delaware corporation formed in 1994, develops and globally markets engineering simulation software and services widely used by engineers, designers, researchers and students across a broad spectrum of industries and academia, including aerospace and defense, automotive, electronics, semiconductors, energy, materials and chemical processing, turbomachinery, consumer products, healthcare, and sports. Headquartered south of Pittsburgh, Pennsylvania, we employed approximately 4,100 people as of December 31, 2019. We focus on the development of open and flexible solutions that enable users to analyze designs directly on the desktop, providing a common platform for fast, efficient and cost-conscious product development, from design concept to final-stage testing and validation. We distribute our suite of simulation technologies through a global network of independent resellers and distributors (collectively, channel partners) and direct sales offices in strategic, global locations. It is our intention to continue to maintain this hybrid sales and distribution model. We operate and report as one segment.

Our product portfolio consists of the following:

Platform

Ansys Workbench™ is the framework upon which our suite of advanced engineering simulation technologies is built. The innovative project schematic view ties together the entire simulation process, guiding the user through complex multiphysics analyses with drag-and-drop simplicity. With bi-directional computer-aided design (CAD) connectivity, powerful highly-automated meshing, a project-level update mechanism, pervasive parameter management and integrated optimization tools, the Ansys Workbench platform enables Pervasive Engineering Simulation™.

Our Workbench framework allows engineers and designers to incorporate the compounding effects of multiple physics into a virtual prototype of their design and simulate its operation under real-world conditions. As product architectures become smaller, lighter and more complex, companies must be able to accurately predict how products will behave in real-world environments where multiple types of physics interact in a coupled way. Our multiphysics software enables engineers to simulate the interactions between structures, heat transfer, fluids and electronics all within a single, unified engineering simulation environment.

Ansys Workbench enables companies to create a customized simulation environment to deploy specialized simulation best practices and automations unique to their product development process or industry. With Ansys ACT™, our partners and end users can modify the user interface, process simulation data or embed third-party applications to create specialized tools based on Ansys Workbench.

Our high-performance computing (HPC) product suite enables enhanced insight into product performance and improves the productivity of the design process. The HPC product suite delivers cross-physics parallel processing capabilities for the full spectrum of our simulation software by supporting structures, fluids, thermal and electronics simulations. This product suite decreases turnaround time for individual simulations, allowing users to consider multiple design ideas and make the right design decisions early in the design cycle.

Refer to the section titled "New Product Offerings" for solutions added to our platform offerings in 2019.

Structures

Our structural analysis product suite offers simulation tools for product design and optimization that increase productivity, minimize physical prototyping and help to deliver better and more innovative products in less time. These tools tackle real-world analysis problems by making product development less costly and more reliable. In addition, these tools have capabilities that cover a broad range of analysis types, elements, contacts, materials, equation solvers and coupled physics capabilities, all targeted toward understanding and solving complex design problems. We also provide comprehensive topology optimization tools that engineers use to design structural components to meet loading requirements with minimal material and component weight. We offer a complete simulation workflow for additive manufacturing that allows reliable 3D printing by simulating the laser sintering process and delivering compensated CAD geometries that ensure reliable printed parts.

Fluids

Our fluids product suite enables modeling of fluid flow and other related physical phenomena. Fluid flow analysis capabilities provide all the tools needed to design and optimize new fluids equipment and to troubleshoot already existing installations. The suite contains general-purpose computational fluid dynamics software and specialized products to address specific industry applications.

Electromagnetics

Our electromagnetics product suite provides field simulation software for designing high-performance electronic and electromechanical products. The software streamlines the design process and predicts performance of mobile communication and internet-access devices, broadband networking components and systems, integrated circuits (ICs) and printed circuit boards (PCBs), as well as electromechanical systems such as automotive components and power electronics equipment, all prior to building a prototype.

Semiconductors

Advancements in semiconductor design and manufacturing enable smaller electronic architectures. Shrinking geometries, especially in the emerging 3D IC, FinFET and stacked-die architectures, reveal design challenges related to power and reliability. Our power analysis and optimization software suite manages the power budget, power delivery integrity and power-induced noise in an electronic design, from initial prototyping to system sign-off. These solutions deliver accuracy with correlation to silicon measurement; the capacity to handle an entire electronic system, including IC, package and PCB, efficiently for ease-of-debugging and fast turnaround time; and comprehensiveness to facilitate cross-domain communications and electronic ecosystem enablement.

Embedded Software

Our SCADÉ[®] product suite is a comprehensive solution for embedded software simulation, code production and automated certification. It has been developed specifically for use in critical systems with high dependability requirements, including aerospace, rail transportation, nuclear, industrial and automotive applications. SCADÉ software supports the entire development workflow, from requirements analysis and design, through verification, implementation and deployment. SCADÉ solutions easily integrate with each other and the rest of our product suite, allowing for development optimization and increased communication among team members.

Systems

We deliver a unique and comprehensive system simulation capability that is ideal for the design of today's increasingly automated products. This collaborative environment leverages our multiphysics, multibody dynamics, circuit and embedded software simulation capabilities, enabling users to simulate the complex interactions between components, circuits and control software within a single environment. These technologies provide a complete view into predicted product performance, which creates greater design confidence for engineers.

3D Design

Our Discovery[™] product family allows every engineer to benefit from the insight of simulation in their product design. The Discovery products range from early design exploration tools powered by interactive real-time simulation and intuitive geometry editing, to detailed product validation solutions utilizing proven flagship solver technology with easy-to-use guided workflows. These tools allow for design engineers of all levels of expertise to utilize simulation across the entire product design process and to work seamlessly with simulation experts using our flagship products for even more advanced analysis.

Optical

Using optical sensor and closed-loop, real-time simulation, our capabilities now span the simulation of all sensors, including lidar, cameras and radar; the multiphysics simulation of physical and electronic components; the analysis of systems functional safety; as well as the automated development of safety-certified embedded software. This functionality can be integrated into a closed-loop simulation environment that interacts with weather and traffic simulators, enabling thousands of driving scenarios to be executed virtually.

Materials

Ansys Granta products give our customers access to material intelligence, including data that is critical to simulations. Refer to the section titled "New Product Offerings" for additional discussion around our materials offerings.

Academic

Our academic product suite provides a highly scalable portfolio of academic products based on several usage tiers, including associate, research and teaching. Each tier includes various non-commercial products that bundle a broad range of physics and advanced coupled field solver capabilities. The academic product suite provides entry-level tools intended for class demonstrations and hands-on instruction. It includes flexible terms of use and more complex analysis suitable for doctoral and post-doctoral research projects. We also provide a special product at no cost to students that is suitable for use away from the classroom and in non-commercial applications.

PRODUCT DEVELOPMENT

We make significant investments in research and development and emphasize frequent, integrated product releases. Our product development strategy centers on ongoing development and innovation of new technologies to increase productivity and to provide engineering simulation solutions that customers can integrate into enterprise-wide product lifecycle management (PLM) systems. Our product development efforts focus on extensions of the full product line with new functional modules, further integration with CAD, electronic CAD (ECAD) and PLM products, and the development of new products. Our products run on the most widely-used engineering computing platforms and operating systems, including Windows, Linux and most UNIX workstations.

Our total research and development expenses were \$298.2 million, \$233.8 million and \$202.7 million in 2019, 2018 and 2017, respectively, or 19.7%, 18.1% and 18.5% of total revenue, respectively. As of December 31, 2019 and 2018, our product development staff consisted of approximately 1,500 and 1,200 employees, respectively, most of whom hold advanced degrees and have industry experience in engineering, mathematics, computer science or related disciplines. We have traditionally

invested significant resources in research and development activities and intend to continue to make investments in expanding the ease of use and capabilities of our broad portfolio of simulation software products.

We recently completed the following major product development activities and releases:

- In January 2020, we released Ansys 2020 R1, which streamlines product development lifecycles and helps boost product performance with enhancements to the interfaces, functionality and power of our simulation solvers. Among these advances is Ansys Minerva, a knowledge management application platform that delivers an integrated suite of Ansys tools, fusing simulation and optimization to product lifecycle processes across any enterprise. Minerva spurs collaboration within global engineering teams and increases data sharing to innovate product designs and reduce development costs. From improving product development with Ansys Minerva to running complex simulations with substantially streamlined workflows with Ansys Fluent to optimizing electromagnetic design processes with Ansys HFSS, Ansys 2020 R1 helps enable companies to pioneer innovations and create cost-effective designs.

To leverage the combined benefits of cloud computing and best-in-class engineering simulation, we are partnering with Microsoft® Azure™ to create a secure cloud solution. In Ansys 2020 R1, Ansys Cloud™ introduced new licensing options to enable greater business flexibility. Companies can cost optimize cloud software usage by mixing elastic (usage-based) and traditional (leased or paid-up) licensing while accessing on-demand compute resources. In addition, within Ansys Mechanical, Ansys Fluent and Ansys Electronics Desktop, you can directly access HPC in the Cloud.

- In September 2019, we released Ansys 2019 R3, which strengthens our autonomous vehicles (AV) solutions with the addition of Ansys Autonomy. Ansys Autonomy enables engineers to develop safer AV through advanced closed-loop scenario simulation, automated driving and control software development, functional safety analysis, and sensor, camera, lidar, and radar simulation. Among a number of other enhancements to our product portfolio, Ansys 2019 R3 also includes the SPEOS Road Library for Sensors Simulation, a comprehensive, retro-reflecting materials database, as well as updates to Ansys HFSS SBR+ that provide greater accuracy in predicting radar cross sections of large targets with curvatures.

As fully autonomous vehicles edge closer to real-world deployment, operating safely becomes more critical than ever. AVs require rigorous testing in complex environments and under variable conditions. Physical testing would require billions of miles of driving or flying — a time-consuming, cost-prohibitive approach. Using simulation to virtually test AVs is the only viable option for validating systems safety and accelerating AV development. From sensors to virtual environments to artificial intelligence, Ansys 2019 R3 includes robust offerings that speed the safe development and deployment of AVs on the road and in the air.

- In June 2019, we released Ansys 2019 R2, which accelerates, streamlines and simplifies the product life cycle through new functionalities. With the new functionalities, including new materials capabilities for structural analysis following the acquisition of Granta Design Limited (Granta Design), our simulation solutions accelerate collaboration, validation and verification, creating a reliable digital thread throughout operations. The release also includes a revolutionary Ansys Mechanical™ user experience, simplified simulation of complex electronics and a new Ansys Fluent™ workflow that significantly speeds meshing of dirty geometries.

New Product Offerings

Our 2019 acquisitions, each a leader in their respective fields, are intended to bolster our strategy of Pervasive Engineering Simulation. The acquired technologies offer solutions that significantly enhance our portfolio, providing solutions valuable to our customers.

The acquisition of material intelligence leader Granta Design gives our customers access to material intelligence, including data that is critical to successful simulations. With Granta Design technology, our customers benefit from access to the world's premier system for managing corporate material intelligence and the market-leading solution for materials sources, selection and management. Ansys Granta MI is a leading system for materials information management in engineering enterprises. Ansys Granta Selector is the standard tool for materials selection and graphical analysis of materials properties. A comprehensive materials data library plus unique software tools enable engineers to use materials to innovate and evolve products, quickly identify solutions to material issues, confirm and validate choice of materials, and reduce material and development costs. CES EduPack is a unique set of teaching resources that supports materials education across engineering, design, science and sustainable development. Granta Materials Data for Simulation provides easy access to materials property data from within Ansys Mechanical and the Ansys Electronics Desktop environment.

The acquisition of Helic, Inc. (Helic), an industry-leading provider of electromagnetic (EM) crosstalk solutions for systems on chips, combined with our flagship electromagnetic and semiconductor solvers, provides a comprehensive solution for on-chip, 3DIC and chip-package-system electromagnetics and noise analysis. Helic's software products (VeloceRF, RaptorX, Exalto and Pharos) help engineers analyze and mitigate the risk of on-chip EM crosstalk, which can lead to silicon failure and time to market delays. VeloceRF is an inductive device synthesizer and modeler for geometries as small as 5 nm and frequencies up to 110Ghz. RaptorX is an electromagnetic modeling, extraction and analysis tool for chip designs pre-layout-vs-schematic (LVS). Exalto is a post-LVS resistance, capacitance, self and mutual inductance (RLCK) extraction tool for electromagnetic coupling. Pharos is a tool that identifies wires that are susceptible to EM and substrate crosstalk.

The acquisition of DfR Solutions' electronics reliability technology, combined with our existing multiphysics portfolio, gives customers a complete designer-level solution to analyze for electronics failure earlier in the design cycle. DfR Solutions' Sherlock is the industry's only automated design reliability analysis software. Sherlock revolutionizes electronic design by empowering designers to simulate real-world conditions and accurately model PCBs and assemblies to predict solder fatigue due to thermal, mechanical, and shock and vibration conditions. During pre-processing, Sherlock automatically translates ECAD and MCAE data into 3D finite element models in minutes. In post-processing, Sherlock automates thermal derating and democratizes the thermal and mechanical analysis of electronics - meaning analysis is done in minutes rather than weeks. Sherlock seamlessly integrates with already existing simulation workflows in the hardware design process making Ansys SIwave, Ansys Icepak and Ansys Mechanical users more efficient. It directly connects simulation to material and manufacturing costs.

Our acquisition of Livermore Software Technology (LST) and its technologies empower customers to solve a new class of engineering challenges, including developing safer automobiles, aircraft and trains while reducing or even eliminating the need for costly physical testing. LST's LS-DYNA is an advanced general-purpose multiphysics simulation software package that can simulate many complex, real-world problems. LS-DYNA is the most advanced multiphysics simulation technology for high-speed, short-duration events (for example, a cell phone drop or automotive crash). Additionally, the acquisition results in an even tighter integration between LS-DYNA and Ansys Workbench (already a leading pre- and post-processor for LS-DYNA) computations. Most automotive companies use LS-DYNA to design and optimize automobile components or entire vehicles to produce safe cars for consumers. Companies all over the world have developed a trust in LST for their vehicle development process due to deep technical relationships. While we have partnered with LST for years, their industry-leading vehicle crash capabilities were not traditionally part of our offerings. Now, we have much greater access and available know-how in those industries to sell the rest of our platform.

Our acquisition of Dynardo, a leading provider of multidisciplinary analysis and optimization technology, gives customers access to a full suite of process integration and robust design tools — empowering users to identify optimal product designs faster and more economically. Dynardo's flagship offering, optiSLang, is a comprehensive multi-disciplinary design optimization solution with a full suite of multi-objective optimization, sensitivity, reliability, and robust design capabilities. Customers of all sizes and across industries leverage optiSLang to integrate chained simulation flows and automate execution for design space exploration and optimization, greatly reducing development time and accelerating the evaluation of optimal product design alternatives for cost and performance. Ansys optiSLang has an intuitive graphical user interface that enables engineers to connect computer-aided design tools together in a way that captures both the simulation process automation and workflows, such as sensitivity analysis or robust design optimization. Ansys optiSLang supports interfacing with most software tools used in virtual product development.

Ansys Minerva is a centralized knowledge management application engineered with an open and vendor-neutral architecture that improves multiphysics collaboration by making data, project plans and analytics easily accessible in one place so team members across the world and in different functional silos can work with the same, most up-to-date information. Minerva improves productivity and maximizes the value of existing engineering technology investments by providing simulation process and data management, life cycle traceability, process integration, design optimization and simulation-driven data science capabilities. Available for both on-premise and cloud deployment, Minerva connects to most leading product life cycle management systems.

PRODUCT QUALITY

Our employees generally perform product development tasks according to predefined quality plans, procedures and work instructions. Certain technical support tasks are also subject to a quality process. These plans define, for each project, the methods to be used, the responsibilities of project participants and the quality objectives to be met. The majority of software products are developed under a quality system that is certified to the ISO 9001:2015 standard. We establish quality plans for our products and services, and subject product designs to multiple levels of testing and verification in accordance with processes established under our quality system.

SALES AND MARKETING

We distribute and support our products through our own direct sales offices, as well as a global network of independent channel partners. This channel partner network provides us with a cost-effective, highly-specialized channel of distribution and technical support. It also enables us to draw on business and technical expertise from a global network, provides relative stability to our operations to help mitigate geography-specific economic trends and provides us with an opportunity to take advantage of new geographic markets or enhance our sales coverage in existing markets.

The channel partners sell our products to new customers, expand installations within the existing customer base, offer training and consulting services, and provide the first line of our technical support. Our channel partner certification process helps to ensure that each channel partner has the ongoing capability to adequately represent our expanding product lines and to provide an acceptable level of training, consultation and customer support. We derived 22.9%, 22.4% and 24.8% of our total revenue through the indirect sales channel for the years ended December 31, 2019, 2018 and 2017, respectively.

We also have a direct sales organization to develop an enterprise-wide, focused sales approach and to implement a worldwide go-to-market account strategy. The sales management organization also functions as a focal point for requests from the channel partners and provides additional support in strategic locations through the presence of direct sales offices.

During 2019, we continued to invest in our existing domestic and international strategic sales offices. In total, our direct sales organization comprised 2,100 and 1,700 employees as of December 31, 2019 and 2018, respectively, who were responsible for the sales, technical support, consulting services, marketing initiatives and administrative activities designed to support our overall revenue growth and expansion strategies.

Our products are utilized by organizations ranging in size from small consulting firms to the world's largest industrial companies. No single customer accounted for more than 5% of our revenue in 2019, 2018 or 2017.

Information with respect to foreign and domestic revenue may be found in Note 17 to the consolidated financial statements in Part IV, Item 15 of this Annual Report on Form 10-K and in the section entitled "Management's Discussion and Analysis of Financial Condition and Results of Operations" in Part II, Item 7 of this Annual Report on Form 10-K.

STRATEGIC ALLIANCES AND MARKETING RELATIONSHIPS

We have established and continued to pursue strategic alliances with advanced technology suppliers, cloud computing providers, hardware vendors, specialized application developers, and CAD, ECAD and PLM providers. We believe that these relationships facilitate accelerated incorporation of advanced technology into our products, provide access to new customers, expand our sales channels, develop specialized product applications and provide direct integration with leading CAD, electronic design automation (EDA), product data management and PLM systems.

We have technical and marketing relationships with leading CAD vendors, such as Autodesk, PTC and Siemens Digital Industries, to provide direct links between products. These links facilitate the transfer of electronic data models between the CAD systems and our products.

We partnered with PTC to accelerate product innovation by providing customers a world-class simulation-driven design solution. Working together, we are delivering Ansys Discovery Live real-time simulation within PTC's Creo[®] 3D CAD software. The combined solution, Creo Simulation Live, is sold by PTC as part of the Creo product suite. This solution offers customers a unified modeling and simulation environment, removing the boundaries between CAD and simulation and enabling design engineers to gain insight into each of the many design decisions they make throughout the product development process. This insight enables design engineers to create higher quality products, while reducing product and development costs.

Similarly, we maintain marketing and software development relationships with leading EDA software companies, including Cadence Design Systems, Synopsys, Mentor Graphics, Zuken and National Instruments. These relationships support the transfer of data between electronics design and layout software and our electronics simulation portfolio. In 2017, we entered into an integration and distribution agreement with Synopsys to cooperatively integrate Ansys RedHawk technology into an in-design add-on to a Synopsys design tool for the primary purpose of providing customers with direct, in-design access to the RedHawk technology's capabilities.

We also have relationships with Siemens and Spatial Corporation to provide the 3D modeling kernel and format translation technologies upon which our in-house geometry modeling software solutions are built.

The main method we employ to democratize HPC to a wider audience is through partnerships with a number of companies, such as cloud computing providers, HPC hardware manufacturers and supercomputing centers such as HLRS in Stuttgart,

Germany. In 2019, we launched a new cloud service fully managed by us and developed in collaboration with Microsoft Azure that provides on-demand access to HPC directly from within our flagship applications. We also collaborated with Flexera to improve our elastic licensing solution by now supporting on-premise use and internet-based usage monitoring. We added Hewlett Packard Enterprises and Dell Technologies as new members to the HPC appliance program that is designed to simplify and accelerate HPC cluster deployment.

Our open cloud strategy allows us to work with various public cloud providers and cloud-hosting partners. This approach makes it easy for customers to use the same workflows on-premise and in the Cloud. Cloud-hosting partners such as Nimbix, Rescale and Gompute provide cloud access to us and/or third-party applications for customers having very complex workflows or other restrictive security certification requirements. Furthermore, we continued to enjoy mutually-committed alliances with large cloud platform providers such as Microsoft, AWS, Google and Alibaba. In 2018, we entered into an agreement with SAP SE (SAP) to embed our pervasive simulation solutions for digital twins into SAP's market-leading digital supply chain, manufacturing and asset management portfolio. The partnership's first solution launched in 2019 and runs on the SAP Cloud Platform and empowers industrial asset operators to optimize operations and maintenance through real-time engineering insights, which reduces product cycle times and increases profitability.

Our Partner Program actively encourages developers of specialized software solutions to use our technology as a development platform for their applications and provides customers with enhanced functionality related to their use of our software. With more than 200 active solution partnerships, spanning a wide range of technologies, including materials, optimization, electronics, optical, mechanical, fluid and systems simulation, our partner ecosystem extends the depth and breadth of our technology offerings.

We have a software license agreement with HBM that provides the advanced fatigue capabilities of nCode DesignLife™, a leading durability software from HBM. nCode DesignLife™ technology leverages the open architecture of our platform and enables mechanical engineers to more easily address complex product life and durability issues before a prototype is built. A similar agreement was executed with VirtualMotion to offer Ansys Motion™ as a tightly-integrated, next-generation capability for simulating complex multi-body mechanisms and assemblies.

COMPETITION

We believe that the principal factors affecting sales of our software include ease of use, breadth and depth of functionality, flexibility, quality, ease of integration with other software systems, file compatibility across computer platforms, range of supported computer platforms, performance, price and total cost of ownership, customer service and support, company reputation and financial viability, and effectiveness of sales and marketing efforts.

We continue to experience competition across all markets for our products and services. Our competitors include large, global, publicly traded companies; small, geographically-focused firms; startup firms; and solutions produced in-house by the end users. Some of our current and possible future competitors have greater financial, technical, marketing and other resources than us, and some have well-established relationships with current and potential customers of ours. Our current and possible future competitors also include firms that have elected, or may in the future elect, to compete by means of open source licensing. These competitive pressures may result in decreased sales volumes, price reductions and/or increased operating costs, and could result in lower revenues, margins and net income.

PROPRIETARY RIGHTS AND LICENSES

We regard our software as proprietary and rely on a combination of trade secret, copyright, patent and trademark laws, license agreements, nondisclosure and other contractual provisions, and technical measures to protect our proprietary rights in our products. We distribute our software products under software license agreements that predominantly grant customers nonexclusive licenses, which are typically nontransferable, for the use of our products. License agreements for our products are generally directly between us and end users. Use of the licensed software product is restricted to specified sites unless the customer obtains a multi-site license for its use of the software product or the software product is by its nature a multi-site use product. Software security measures are also employed to prevent unauthorized use of our software products and the licensed software is subject to terms and conditions prohibiting unauthorized use or reproduction. For most products, customers may purchase a perpetual license of the technology with the right to annually purchase ongoing maintenance, technical support and upgrades, or may lease the product on a fixed-term basis for a fee that includes the license, maintenance, technical support and upgrades. For some products, customers purchase an annual subscription for a certain number of named users that includes the license, maintenance, technical support and upgrades or purchase elastic units hosted by our Cloud and use any supported product at any time until their licensed volume is met.

We license our software products utilizing a combination of web-based and hard-copy license terms and forms. For certain software products, we primarily rely on "click-wrapped" licenses (i.e. online agreements where the website provider posts terms and conditions, and the user clicks on the "accept" button). The enforceability of these types of agreements under the laws of some jurisdictions is uncertain.

We also seek to protect the source code of our software as a trade secret and as registered unpublished copyrighted work. We have obtained federal trademark registration protection for Ansys and other marks in the U.S. and foreign countries. Additionally, we were awarded numerous patents by the U.S. Patent and Trademark Office and have a number of patent applications pending. To the extent we do not choose to seek patent protection for our intellectual property, we primarily rely on the protection of our source code as a trade secret. We seek additional protection of our proprietary rights in our source code via copyright registrations.

Our employees have signed agreements under which they have agreed not to disclose trade secrets or confidential information. These agreements, where legally permitted, restrict engagement in or connection with any business that is competitive with us anywhere in the world while employed by us (and, in some cases, for specified periods thereafter) and state that any products or technology created by employees during their term of employment are our property. In addition, we require all channel partners to enter into agreements not to disclose our trade secrets and other proprietary information.

Despite these precautions, there can be no assurance that misappropriation of our technology and proprietary information (including source code) will be prevented. Further, there can be no assurance that copyright, trademark, patent and trade secret protection will be available for our products in certain jurisdictions, or that restrictions on the ability of employees and channel partners to engage in activities competitive with us will be enforceable. Costly and time-consuming litigation could be necessary in the future to enforce our rights to our trade secrets and proprietary information or to enforce our patent rights and copyrights, and it is possible that, in the future, our competitors may be able to obtain our trade secrets or to independently develop similar, unpatented technology.

The software development industry is characterized by rapid technological change. Therefore, we believe that factors such as the technological and creative skills of our personnel, new product developments, frequent product enhancements, name recognition and reliable product maintenance are also important to establishing and maintaining technology leadership in addition to the various legal protections of our technology that may be available.

We do not believe that any of our products infringe upon the proprietary rights of third parties. There can be no assurance, however, that third parties will not claim such infringement by us or our licensors or licensees with respect to current or future products. In addition, there are non-practicing entities (NPEs) and patent assertion entities (PAEs) whose business models are built on not producing any products but rather extracting payments from revenue generating companies through patent infringement assertions and/or litigation. We expect that software suppliers will increasingly be subject to the risk of such claims as the number of products and suppliers continues to expand and the functionality of products continues to increase. Any such claims, with or without merit, could be time consuming, result in costly litigation, cause product release delays or require us to enter into royalty or licensing agreements. Such royalty or licensing agreements, if required, may not be available on terms acceptable to us.

SEASONAL VARIATIONS

Our business has experienced seasonality, including quarterly reductions in software sales resulting from slowdowns of customer activities during the summer months, particularly in Europe, as well as from the seasonal purchasing and budgeting patterns of our global customers. Lease and maintenance contract renewals are typically highest in the first and fourth quarters. Our revenue is typically highest in the fourth quarter.

DEFERRED REVENUE AND BACKLOG

Deferred revenue consists of billings made or payments received in advance of revenue recognition from customer agreements. The deferred revenue on our consolidated balance sheets does not represent the total value of annual or multi-year, noncancellable agreements. Our backlog represents installment billings for periods beyond the current quarterly billing cycle. Our deferred revenue and backlog as of December 31, 2019 and 2018 consisted of the following:

<i>(in thousands)</i>	Balance at December 31, 2019		
	Total	Current	Long-Term
Deferred revenue	\$ 365,274	\$ 351,353	\$ 13,921
Backlog	505,469	218,398	287,071
Total	<u>\$ 870,743</u>	<u>\$ 569,751</u>	<u>\$ 300,992</u>

<i>(in thousands)</i>	Balance at December 31, 2018		
	Total	Current	Long-Term
Deferred revenue	\$ 343,174	\$ 328,584	\$ 14,590
Backlog	315,998	147,299	168,699
Total	<u>\$ 659,172</u>	<u>\$ 475,883</u>	<u>\$ 183,289</u>

Revenue associated with deferred revenue and backlog that will be recognized in the subsequent twelve months is classified as current in the tables above.

EMPLOYEES

As of December 31, 2019, we employed approximately 4,100 people. At that date, there were also contract personnel and co-op students providing ongoing development services and technical support. Certain employees are subject to collective bargaining agreements and have local work councils.

ACQUISITIONS

We make targeted acquisitions in order to support our long-term strategic direction, accelerate innovation, provide increased capabilities to our existing products, supply new products and services, expand our customer base and enhance our distribution channels.

2019 Acquisitions

On November 1, 2019, we completed the acquisition of 100% of the shares of LST for a purchase price of \$777.8 million.

On February 1, 2019, we completed the acquisition of 100% of the shares of Granta Design for a purchase price of \$208.7 million.

Additionally, during the year ended December 31, 2019, we acquired Dynardo, Helic and DfR Solutions to combine the acquired technologies with our existing comprehensive multiphysics portfolio. These acquisitions were not individually significant. The combined purchase price of these acquisitions was \$136.2 million.

The 2019 acquisitions are further described in the table below:

Date of Closing	Company	Details
November 1, 2019	LST	LST, the premier provider of explicit dynamics and other advanced finite element analysis technology, empowers our customers to solve a new class of engineering challenges, including developing safer automobiles, aircraft and trains while reducing or even eliminating the need for costly physical testing.
November 1, 2019	Dynardo	Dynardo, a leading provider of multidisciplinary analysis and optimization technology, gives our customers access to a full suite of process integration and robust design tools — empowering users to identify optimal product designs faster and more economically.
May 1, 2019	DfR Solutions	DfR Solutions' electronics reliability technology, combined with our existing comprehensive multiphysics portfolio, gives our customers a complete designer-level solution to analyze for electronics failure earlier in the design cycle.
February 4, 2019	Helic	Helic, the industry-leading provider of electromagnetic crosstalk solutions for systems on chips, combined with our flagship electromagnetic and semiconductor solvers, provides a comprehensive solution for on-chip, 3D integrated circuit and chip-package-system electromagnetics and noise analysis.
February 1, 2019	Granta Design	Granta Design, the premier provider of materials information technology, expands our portfolio into this important area, giving customers access to materials intelligence, including data that is critical to successful simulations.

2018 Acquisition

On May 2, 2018, we completed the acquisition of 100% of the shares of OPTIS, a premier provider of software for scientific simulation of light, human vision and physics-based visualization, for a purchase price of \$291.0 million. The acquisition extended our portfolio into the area of optical simulation to provide comprehensive sensor solutions, covering visible and infrared light, electromagnetics and acoustics for camera, radar and lidar.

2017 Acquisitions

During the year ended December 31, 2017, we completed various acquisitions which were not individually significant. The combined purchase price of the acquisitions was approximately \$67.0 million.

The 2017 technology acquisitions are further described in the table below:

Date of Closing	Company	Details
November 15, 2017	3DSIM	3DSIM, a developer of premier additive manufacturing technology, gives us a complete additive manufacturing simulation workflow solution. 3DSIM's software solutions empower manufacturers, designers, materials scientists and engineers to achieve their objectives through simulation-driven innovation rather than physical trial and error.
July 5, 2017	Computational Engineering International, Inc. (CEI Inc.)	CEI Inc., the developer of EnSight, aids engineers and scientists in their ability to analyze, visualize and communicate large simulation data sets in clear, higher-resolution outputs.
March 10, 2017	CLK Design Automation (CLK-DA)	CLK-DA offers fast transistor simulation technology that complements our semiconductor product portfolio.

For further information on our business combinations, see Note 4 to the consolidated financial statements included in Part IV, Item 15 of this Annual Report on Form 10-K.

AVAILABLE INFORMATION

Our website is www.ansys.com and our investor relations website is <https://investors.ansys.com>. We make available on our investor relations website, free of charge, Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, interactive data files, Current Reports on Form 8-K, reports filed pursuant to Section 16 and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, as soon as reasonably practicable after such materials are electronically filed or furnished to the Securities and Exchange Commission (SEC). Our reports may also be obtained by accessing the EDGAR database of the SEC's website at www.sec.gov.

ITEM 1A. RISK FACTORS

The following are important factors we have identified that could affect our future results and an investment in our common stock. In addition, from time to time we provide information, including information contained in this Annual Report on Form 10-K, that contains forward-looking statements concerning, among other things, projected financial performance, total addressable market, market and industry sector growth, product development and commercialization or other aspects of future operations. Such statements are based on the assumptions and expectations of our management at the time such statements are made. We caution investors that our performance and any forward-looking statements are subject to risks and uncertainties, including but not limited to, the following:

Global Operational Risks

Adverse economic and geopolitical conditions may impact our operations and financial performance.

Our operations and performance depend significantly on global macroeconomic, specific foreign country and U.S. domestic economic conditions. Adverse conditions in the macroeconomic environment may result in a decreased demand for our products and services, constrained credit and liquidity, reduced government spending and volatility in equity and foreign exchange markets. In addition, to the extent the global economy experiences a significant downturn or volatility, we may be exposed to impairments of certain assets if their values deteriorate. Tighter credit due to economic conditions may diminish our future borrowing ability and increase borrowing costs under our existing credit facilities. Customers' ability to pay for our products and services may also be impaired, which could lead to an increase in our allowance for doubtful accounts and write-offs of accounts receivable.

A majority of our business comes from outside the U.S. and our customers supply a wide array of goods and services to most of the world's major economic regions. International revenue represented 57.9%, 60.9% and 61.9% of our total revenue for the years ended December 31, 2019, 2018 and 2017, respectively. In fiscal year 2019, our largest geographic revenue bases included the U.S., Japan, Germany and South Korea.

If any of the foreign economies in which we do business deteriorates or suffers a period of uncertainty, our business and performance may be negatively impacted through reduced customer and government spending, changes in purchasing cycles or timing, reduced access to credit for our customers, or other factors impacting our international sales and collections. Furthermore, customer spending levels in any foreign jurisdiction may be adversely impacted by changes in domestic policies, including tax and trade policies. For example, the United Kingdom withdrew from the European Union effective as of January 31, 2020 and is now in a period of transition until the end of 2020. We have significant operations in the United Kingdom and the European Union. It remains unclear as to what the terms of the new relationship between the United Kingdom and the European Union will be. Terms that are disadvantageous to us, including those related to trade, tax and the movement of people across borders could negatively impact our results.

A substantial portion of our license and maintenance revenue is derived from annual lease and maintenance contracts which typically have a high rate of customer renewal. If the rate of renewal for these contracts is adversely affected by economic or other factors, our lease license and maintenance growth will be adversely affected. As a result, our business, financial position, results of operations and cash flows may also be adversely impacted during those periods.

We face compliance risk as a result of our international operations and our sales model, including pertaining to anti-corruption and data privacy laws.

The laws with which we need to comply due to our international operations vary from country to country and are subject to frequent change and interpretation. In May 2018, the General Data Protection Regulation (GDPR), which governs data privacy practices within the European Economic Area (EEA), went into effect. The law, which applies to our data processing activities within the EEA, as well as the processing of EEA citizen data globally, imposes various compliance obligations related to the handling of personal data in the delivery of our products and services and to business operations involving employee data. Compliance with the GDPR has and will continue to require deployment of substantial resources and increased costs. If we fail to comply with the GDPR, it may lead to regulatory enforcement actions, which can result in monetary penalties of up to 4% of annual worldwide revenue, private lawsuits, extensive and prescriptive consent decrees or judgments that may require additional resources or expenses for compliance and may cause reputational damage.

In the U.S., California implemented the California Consumer Protection Act (CCPA) as of January 2020, which requires compliance measures similar to those of the GDPR and establishes the first state standard for a comprehensive set of data privacy rights. Several other states have proposed data privacy laws that would impose obligations on us with respect to how we collect and use personal data, including customer data. In order to comply with U.S. state laws, as well as any data breach notification laws that vary across states, we may be required to invest in additional resources or tools to manage our data

processing activities. If we fail to comply with the requirements of U.S. data privacy and data breach notification laws, we will be subject to state monetary fines, consent decrees issued by the Federal Trade Commission, and possible reputational damage.

Our global reach, including within countries considered high-risk environments for public corruption, exposes us to risks associated with violations of anti-bribery laws such as the U.S. Foreign Corrupt Practices Act and the U.K. Bribery Act. We develop and sell software and consulting services and maintain support operations in more than 40 countries whose laws and practices differ from one another and are subject to unexpected changes. Managing these geographically diverse operations requires significant attention and resources to ensure compliance. To promote compliance, we forbid our agents and employees from engaging in corrupt behavior and have implemented a compliance plan to prevent and detect violations of anti-corruption laws. There remains, however, a risk that illegal conduct could occur thereby exposing us to the financial and reputational risks associated with a violation of anti-corruption laws.

Noncompliance with these regulations could adversely impact our financial results or stock price as well as divert management time and effort.

We are subject to trade restrictions that could impact our ability to sell to customers and result in liability for violations.

Due to the global nature of our business, we are subject to import and export restrictions and regulations that prohibit the shipment or provision of certain products and services to certain countries, governments and persons targeted by the U.S., including the Export Administration Regulations administered by the U.S. Bureau of Industry and Security (BIS) and economic and trade sanctions administered by the U.S. Treasury Department's Office of Foreign Assets Control (OFAC). During the second quarter of 2019, the BIS placed certain entities on the Entity List. Certain of our existing and prospective customers, including Huawei, were included in this list. In addition, restrictions implemented by OFAC restrict our ability to sell to some companies in certain countries, such as Russia. The Entity List and OFAC restrictions limit our ability to deliver products and services to these customers and, in the absence of a license, our ability to sell products and services to these customers in the future. The inclusion of companies on the Entity List may encourage them to seek substitute products from competitors who are not subject to these restrictions or to develop their own products. We cannot predict whether or when any changes will be made that eliminate or decrease these limitations on our ability to sell products and provide services to these customers. Additionally, other customers may continue to be added to the Entity List and/or be subjected to trade restrictions. There may be indirect impacts that cannot be quantified, including that our business may also be impacted by other trade restrictions that may be imposed by the U.S., China, or other countries. Restrictions on our ability to sell and ship to customers could have an adverse effect on our business, results of operations or financial condition.

Violators of these export controls may be subject to significant penalties, which may include considerable monetary fines, criminal proceedings against them and their officers and employees, a denial of export privileges, and suspension or debarment from selling products or services to the federal government. Any such penalties could have an adverse effect on our business, financial condition, operating results and cash flows. In addition, the political and media scrutiny surrounding any governmental investigation could cause significant expense and reputational harm and distract senior executives from managing normal day-to-day operations.

Our products could also be shipped to denied parties by third parties, including our channel partners. Even though we take precautions to ensure that our channel partners comply with all relevant import and export regulations, any failure by channel partners to comply with such regulations could have negative consequences for us, including reputational harm, government investigations and penalties.

The effect of foreign exchange rate fluctuation may adversely impact our revenue, expenses, cash flows and financial conditions.

As a result of our significant international presence, we have revenue, expenses, cash, accounts receivable and payment obligations denominated in foreign currencies, most notably the British Pound, Euro, Japanese Yen, South Korean Won and Indian Rupee. Our revenue and operating results are adversely affected when the U.S. Dollar strengthens relative to foreign currencies and are positively affected when the U.S. Dollar weakens relative to foreign currencies. If the U.S. Dollar strengthens relative to other currencies, certain channel partners who pay us in U.S. Dollars may have trouble paying on time or may have trouble distributing our products due to the impact of the currency exchange fluctuation on such channel partner's cash flows. This may impact our ability to distribute our products into certain regions and markets.

We seek to reduce our currency exchange transaction risks primarily through our normal operating and treasury activities, including derivative instruments, but there can be no assurance that these activities will be successful in reducing these risks. In addition, we incur transaction fees in the usage of such derivative instruments. Changes in currency exchange rates will affect our financial position, results of operations and cash flows.

A natural disaster or catastrophic event may disrupt our business.

A significant portion of our software development personnel, source code and computer equipment is located at operating facilities in the U.S., Canada, India, Japan and throughout Europe. The occurrence of a natural disaster or other unforeseen catastrophe at any of these facilities could cause disruptions to our operations, services and product development activities. Additionally, if we experience problems that impair our business infrastructure, such as a computer virus, telephone system failure or an intentional disruption of our information technology systems by a third party, these disruptions could have a material adverse effect on our business, financial position, results of operations, cash flows and the ability to meet financial reporting deadlines. Further, because our sales are not generally consistent across quarterly periods, the potential adverse effects resulting from any of the events described above or any other disruption of our business could be accentuated if they occur close to the end of a fiscal quarter.

In addition, our business could be adversely affected by the effects of a widespread outbreak of contagious disease, including the recent outbreak of respiratory illness caused by a novel coronavirus first identified in Wuhan, Hubei Province, China. Any outbreak of contagious diseases, and other adverse public health developments, may cause us or our customers to temporarily suspend operations in the affected city or country. In addition, a significant outbreak of contagious diseases in the human population could result in a widespread health crisis that could adversely affect the economies and financial markets of many countries, resulting in an economic downturn that could affect demand for our products, our ability to collect against existing trade receivables and our operating results.

Industry Operational Risks**Our industry is highly competitive, which could result in downward pressure on our prices.**

We continue to experience competition across all markets for our products and services. Some of our current and potential competitors have greater financial, technical, marketing and other resources than we do, and some have well-established relationships with our current and potential customers. Our current and potential competitors also include firms that have competed, or may in the future compete, by means of open source licensing. Companies we have, or could have, strategic alliances with could reduce or discontinue technical, software development and marketing relationships with us for competitive purposes. If our competitors offer deep discounts on certain products or services, or develop products that the marketplace considers more valuable, we may need to lower prices or offer discounts or other favorable terms in order to compete successfully. Our maintenance products, which include software license updates and product support fees, are generally priced as a percentage of new software license fees. Our competitors may offer lower percentage pricing on product updates and support. Some competitors may bundle software products for promotional purposes or as a long-term pricing strategy or provide guarantees of prices, product implementations or wider geographical license usage provisions. Any of these practices could, over time, significantly constrain the prices that we can charge for certain products.

Furthermore, if we do not adapt pricing models to reflect changes in customer usage of our products or changes in customer demand, our new software license revenues could decrease. Additionally, increased distribution of applications through application service providers, including software-as-a-service providers, may reduce the average price of our products or adversely affect other sales of our products, reducing new software license revenues unless we can offset price reductions with volume increases.

These competitive pressures may result in decreased sales volumes, price reductions and/or increased operating costs, and could result in lower revenues, margins and net income.

We may not be successful in developing and marketing new products to adequately address the rapidly changing technology industry.

We operate in an industry generally characterized by rapidly changing technology and frequent new product introductions, which can render existing products obsolete or unmarketable. A major factor in our future success will be our ability to anticipate technological changes and to develop and introduce, in a timely manner, new products to meet those changes. Our ability to grow revenue will be dependent on our ability to respond to customer needs in the areas of, among others, 5G, autonomous vehicles, Industrial Internet of Things (IIoT) and electrification, and to leverage cloud computing and new computing platforms. In addition, our future success may depend on our ability to continue to develop a systems integrator ecosystem able to handle integrations and process and application development to address the challenge of the increasingly complex integration of our products' different functionalities to address customers' requirements. In addition, for those customers who authorize a third-party technology partner to access their data, we do not provide any warranty related to the functionality, security and integrity of the data transmission or processing. Despite contract provisions to protect us, customers may look to us to support and provide warranties for the third-party applications, integrations, data and content, even though not developed or sold by us, which may expose us to potential claims, liabilities and obligations, all of which could harm our business.

We devote substantial resources to research and development, which could cause our operating results to decline.

We devote substantial resources to research and development. New competitors, technological advances in the software development industry by us or our competitors, acquisitions, entry into new markets, or other competitive factors may require us to invest significantly greater resources than anticipated. If we are required to invest significantly greater resources than anticipated without a corresponding increase in revenue, operating results could decline. In addition, our periodic research and development expenses may be independent of our level of revenue, which could negatively impact financial results.

There can be no assurance that we will be successful in developing and marketing, on a timely basis, new products or product enhancements or that the new products will adequately address the changing needs of the marketplace or that we will successfully manage the transition from existing products. Software products as complex as those we offer may contain undetected errors when first introduced, or as new versions are released, and the likelihood of errors is increased as a result of our commitment to the frequency of product releases. There can be no assurance that errors will not be found in any new or enhanced products after the commencement of commercial shipments. Certain products require a higher level of sales and support expertise. Failure of our sales channel, particularly the independent channel partners, to obtain this expertise and to sell the new product offerings effectively could have an adverse impact on our sales in future periods. Any of these problems may result in the loss of or delay in customer acceptance, diversion of development resources, damage to our reputation, or increased service and warranty costs, any of which could have a material adverse effect on our business, financial position, results of operations and cash flows.

Consolidation among our customers as well as our industry competitors may negatively impact our operating results.

There have been consolidations among our customers in the semiconductor, electronics and automotive industries, among others. This may result in the newly combined entity wanting the most favorable pricing from the former contracts and expecting larger volume discounts on future purchases. If a customer is acquired by an entity that does not utilize our products in favor of a competing product, we may not have future orders from the enterprise. Further, consolidation of our competitors may result in synergies that allow those competitors to benefit from broader sales channels and increased access to capital. Any of these impacts could adversely affect our business, financial position, results of operations and cash flows.

The price of our common stock is subject to volatility.

The market price of securities of software companies is subject to significant fluctuations. The valuation and trading price of our common stock may not be predictable. Factors that may adversely impact our share price include our failure to meet analyst expectations, reduced expectations regarding financial outlook, increases in our debt levels, changes in management or our material announcements or those of our competitors. In addition, volatility could result from causes that are unrelated to our operating performance such as conditions in the financial markets or the software industry generally.

Company Operational Risks

We are dependent upon our channel partners for a significant percentage of our revenue.

We distribute our products through a global network of independent channel partners, which accounted for 22.9%, 22.4% and 24.8% of our revenue during the years ended December 31, 2019, 2018 and 2017, respectively. Channel partners sell our software products to new and existing customers, expand installations within the existing customer base, offer consulting

services and provide the first line of technical support. In Asia-Pacific and EMEA, we are highly dependent upon our channel partners. Difficulties in ongoing relationships with channel partners, such as failure to meet performance criteria and differences in handling customer relationships, could adversely affect our performance. Additionally, the loss of any major channel partner, including a channel partner's decision to sell competing products rather than ours, could result in reduced revenue. Moreover, our future success will depend substantially on the ability and willingness of our channel partners to dedicate the resources necessary to promote our portfolio of products and to support a larger installed base within each of our geographic regions. If the channel partners are unable or unwilling to do so, we may be unable to sustain revenue growth.

We have been increasing the number of channel partners, particularly in international locations. The business relationships with these channel partners are recently established and could result in additional compliance burdens for us. In addition, these partners have a less-established payment history and revenue from these partners could come with a higher rate of bad debt expense. Where channel partners operate on our behalf to collect and process personal data of customer contacts, failure to comply with relevant data privacy laws in the handling of such personal data could result in our liability for any fines, civil suits or non-financial performance obligations imposed by regulatory authorities on these partners with respect to our customer data.

We may not be able to realize the potential benefit of our acquisitions and such acquisitions could pose risks to our business.

We consummate acquisitions to support our long-term strategic direction. We have completed a number of acquisitions in recent years, and in 2019 we acquired Granta Design, Helic, DfR Solutions, LST and Dynardo.

Any acquisitions that we complete may present risks, including: difficulty in integrating the management teams, strategies, cultures and operations of the companies or businesses; failing to achieve anticipated synergies, revenue increases or cost savings; difficulty incorporating and integrating the acquired technologies or products with our existing product lines; difficulty with sales, distribution and marketing functions; failure to develop new products and services that utilize the technologies and resources of the companies; disruption of our ongoing business and diversion of management's attention to transition or integration issues; liabilities that were not identified during the buying process; the loss of our key employees, customers, partners and channel partners or those of the acquired company; and cybersecurity and data privacy risks, including any liabilities for failure to comply with data privacy laws and obligations for collection, use and retention of personal data.

Future acquisitions may involve the expenditure of significant cash resources; the incurrence of debt, which increases our interest expense and leverage; or the issuance of equity, which is dilutive to stockholders and may decrease earnings per share.

We allocate a portion of the purchase price to goodwill and intangible assets. If we do not recognize all the economic benefits of an acquisition, there could be an impairment of goodwill or intangible assets. Furthermore, impairment charges are generally not tax-deductible and will result in an increased effective income tax rate in the period the impairment is recorded.

If we do not achieve the anticipated benefits of our acquisitions as rapidly or to the extent anticipated by our management or the financial and industry analysts, there could be a material adverse effect on our stock price, business, financial position, results of operations and cash flows. Where customer contacts and leads are a significant consideration in the purchase price or expected financial outcome of an acquisition, failure to identify or mitigate data privacy concerns with the collection, use and retention of personal data may adversely impact our ability to use this information as anticipated and regulatory obligations may require that we delete all or a portion of the database, or take additional remediation measures before use. This may impact the value of the acquisition or reduce forecasted sales.

The implementation of a new CRM system may not achieve the corporate benefits initially identified in the anticipated time frame or at all.

We are in the process of implementing new functionality in our existing Customer Relationship Management (CRM) system. While this system is anticipated to simplify the demand generation, sales cycle, order processing and customer service activities, there is a risk that the project will not achieve the anticipated benefits or that the benefits will not be achieved as quickly as anticipated. There is also a risk that we will have to write off previously capitalized expenditures if the project is not successful or if implementation decisions regarding the project are modified. The project implementation timeline and scope may change and become longer and broader as new facets of the design and implementation efforts are undertaken. This may take the attention of key operational management away from other aspects of the business, including the integration of acquisitions, and may also result in increased consulting and software costs. These factors may have a significant negative impact on our business, financial position, profit, cash flows and reputation.

If we are unable to attract and retain key talent, our business could be adversely affected.

Our success depends upon the continued service of our senior executives and our key technical and sales employees. Each of our executive officers and key technical personnel could terminate his or her relationship with us at any time. The loss of any of our senior executives or key personnel for which there has not been adequate knowledge-sharing and transfer might significantly delay or prevent the achievement of our business objectives and could materially harm our business and customer relationships.

In addition, because of the highly technical nature of our products and services, we must attract and retain highly skilled engineering and development personnel. The market for this talent is highly competitive and we have difficulty filling these roles for this reason. While we have historically recruited from outside of the U.S., in recent years our ability to do so has been curbed by more restrictive domestic immigration laws. If the immigration laws become even stricter or the processing of immigration requests becomes even more cumbersome or less efficient, or if we have less success in recruiting and retaining key personnel, our business, reputation and operating results could be materially and adversely affected.

We may be subject to proceedings that could harm our business.

We are subject to various investigations, claims and legal proceedings that arise in the ordinary course of business, including commercial disputes, labor and employment matters, tax audits and litigations, alleged infringement of intellectual property rights and other matters. Use or distribution of our products could generate product liability, regulatory infraction, or similar claims by our customers, end users, channel partners, government entities or other third parties. Sales and marketing activities that impact processing of personal data, as well as measures taken to ensure license compliance, may also result in claims by customers and individual employees of customers. Each of these matters is subject to various uncertainties, and it is possible that an unfavorable resolution of one or more of these matters could materially and adversely affect our results of operations, cash flows and financial position, as well as cause damage to our reputation.

We may not be able to continue to obtain licenses to third-party software and intellectual property on reasonable terms or at all, which may disrupt our business and harm our financial results.

We license third-party software and other intellectual property for use in product research and development and, in several instances, for inclusion in our products. We also license third-party software, including the software of our competitors, to test the interoperability of our products with other industry products and in connection with our professional services. These licenses may need to be renegotiated or renewed from time to time, or we may need to obtain new licenses in the future. Third parties may stop adequately supporting or maintaining their technology, or they or their technology may be acquired by our competitors. If we are unable to obtain licenses to such third-party software and intellectual property on reasonable terms or at all, we may not be able to sell the affected products, our customers' use of the products may be interrupted, or our product development processes and professional services offerings may be disrupted, which could in turn harm our financial results, our customers' ability to utilize our software, and our reputation.

We may suffer reputational or financial harm if we have product standard or quality issues.

We have separate quality systems and registrations under the ISO 9001:2015 standard in addition to other governmental and industrial regulations. Our continued compliance with quality standards and favorable outcomes in periodic examinations is important to retain current customers and vital to procure new sales. If it was determined that we were not in compliance with various regulatory or ISO 9001 standards, our certificates of registration could be suspended, requiring remedial action and a time-consuming re-registration process. Product quality issues or failures could result in our reputation becoming diminished, resulting in a material adverse impact on revenue, operating margins, net income, financial position and cash flows.

Our short-term and long-term sales forecast may not be accurate which could result in an adverse impact on our business.

The software business is generally characterized by long sales cycles. These long sales cycles increase the difficulty of predicting sales for any particular quarter. Many operational and strategic decisions are based upon short- and long-term sales forecasts. Our sales personnel continually monitor the status of proposals, including the estimated closing date and the value of the sale, in order to forecast quarterly sales. These forecasts are subject to significant estimation and are impacted by many external factors, including global economic conditions and the performance of our customers. A variation in actual sales activity from that forecasted could cause us to plan or budget incorrectly and, therefore, could adversely affect our business, financial position, results of operations and cash flows. Management also forecasts macroeconomic trends and developments and integrates them through long-range planning into budgets, research and development strategies and a wide variety of general management duties. Global economic conditions, and the effect those conditions and any disruptions in global markets have on our customers, may have a significant impact on the accuracy of our sales forecasts. These conditions may increase the likelihood or the magnitude of variations between actual sales activity and our sales forecasts and, as a result, our performance may be hindered because of a failure to properly match corporate strategy with economic conditions. This, in turn, may adversely affect our business, financial position, results of operations and cash flows. To the extent our forecasts are incorrect and, as a result, we fail to meet analyst expectations regarding financial performance or miss or reduce the financial guidance we give to investors, our share price may be adversely impacted.

Intellectual Property and Cybersecurity Risks

Our success is highly dependent upon the legal protection of our proprietary technology.

We primarily rely upon contracts and copyright, patent, trademark and trade secrets laws to protect our technology. We maintain intellectual property programs, including applying for patents, registering trademarks and copyrights, protecting trade secrets, entering into confidentiality agreements with our employees and channel partners, and limiting access to and distribution of our software, documentation and other proprietary information. However, software programs are particularly prone to piracy, which is a global phenomenon, and as a result we may lose revenue from the distribution of unlicensed software. Additionally, patent, copyright, trademark and trade secret protection do not provide the same coverage in every country in which we sell our products and services. Policing the unauthorized distribution and use of our products is difficult, and software piracy (including online piracy) is a persistent problem. While we continue to develop better mechanisms to detect and report or investigate unauthorized use of our software, we are also constrained by data privacy laws that restrict our ability to collect data about unlawful usage in some countries. We cannot assure that the steps we take to protect our proprietary technology are adequate to prevent misappropriation of our software by third parties, or that third parties will not be able to develop similar technology independently. Despite our efforts to prevent such activities, we may nonetheless lose significant revenue due to illegal use of our software.

Costly and time-consuming litigation would be necessary to enforce and determine the scope of trade secret rights and related confidentiality and nondisclosure provisions across our contractual agreements and partnerships. While we are not aware that any of our technology infringes upon the rights of third parties, there can be no assurance that other parties will not assert technology infringement claims against us, or that, if asserted, such claims will not prevail. Any such litigation could be costly to defend, damage our reputation, and distract our employees from their daily work. Any successful infringement claims asserted against us could require us to develop technology workarounds for the impacted products or product development, which could be costly, disrupt product development, and delay go-to-market activities. Such disruption and delay could negatively impact our financial results.

Cyberattacks and security vulnerabilities could lead to reduced revenue, increased costs, liability claims, or harm to our reputation.

While we undertake commercially reasonable efforts to maintain and improve the security and integrity of our products, source code, computer systems and data with respect to the relative sensitivity of such software, systems and data, the number of computer “hackers” developing and deploying destructive software programs that attack our products and computer systems continues to increase. We have incurred and will continue to incur additional costs to enhance our cybersecurity efforts. Because the tactics and tools used to obtain unauthorized access to networks or to sabotage systems are constantly evolving, we may be unable to implement adequate preventive measures. Such an attack could disrupt the proper functioning of our products, cause errors in the output of our customers' work, or allow unauthorized access to and disclosure of our sensitive, proprietary or confidential information or that of our customers and employees. In the event of a serious breach of our products or systems, or where a breach occurs due to our failure to implement reasonable and appropriate safeguards, our reputation may suffer, customers may stop buying products or may terminate current services, we could face lawsuits and potential civil liability, as well as regulatory fines and non-financial penalties for any personal data breach, and our financial performance could be negatively impacted.

There is also a danger of industrial espionage, cyberattacks, misuse, theft of information or assets (including source code), or damage to assets by people who have gained unauthorized access to our facilities, systems or information. This includes access to systems or information through email phishing attacks on our employees which has become a very prevalent technique used against companies, often delaying detection through increasingly complex practices. The objective of these attacks is often to acquire user account credentials in order to access other computer systems through linked accounts or where users have recycled passwords across systems.

Inadequate security practices or inadvertent acts or omissions by our employees and partners may also result in unauthorized access to our data. Employees or third parties may also intentionally compromise our or our customers' security or systems. Such cybersecurity breaches, misuse of data or other disruptions could lead to loss of or unauthorized disclosure of our source code or other confidential information, unlicensed use and distribution of our products without compensation, illegal use of our products that could jeopardize the security of customer information stored in and transmitted through our computer systems, and theft, manipulation and destruction of proprietary data, resulting in defective products, performance downtimes and possible violation of export laws and other regulatory compliance requirements. Although we actively employ measures to combat such activities, preventing unauthorized access to our systems and data is inherently difficult. In addition, litigation to either pursue our legal rights or defend any claims against us could be costly and time-consuming and may divert management's attention and adversely affect the market's perception of us and our products.

We have experienced targeted and non-targeted cybersecurity attacks and incidents in the past that have resulted in unauthorized persons gaining access to our information and systems, and we could in the future experience similar attacks. To date, no cybersecurity incident or attack has had a material impact on our business, results of operations or financial condition.

A number of our core processes, such as software development, sales and marketing, customer service and financial transactions, rely on IT infrastructure and applications. We also rely on third-party service providers and products, which are exposed to various security vulnerabilities outside of our control. Malicious software, sabotage and other cybersecurity breaches of the types discussed above could cause an outage of our infrastructure, which could cause short-term disruption in operations or, in the event of a longer disruption, lead to a substantial denial of service to our customers and ultimately to production downtime, recovery costs and customer claims for breach of contract, as well as reputational damage and impact to employee morale and productivity.

We rely on service providers for infrastructure and cloud-based products.

We use a number of third-party service providers for key components of our infrastructure, particularly with respect to development and delivery of our cloud-based products. The utilization of these service providers gives us greater flexibility in efficiently delivering a more tailored, scalable customer experience but also exposes us to additional risks and vulnerabilities. Those of our products and services that depend upon hosted components delivered by third parties are vulnerable to security risks inherent in web-based technologies, including greater risk of unauthorized access to or use of customers' protected data. Interception of data transmission, misappropriation or modification of data, corruption of data and attacks by bad actors against our service providers may also adversely affect our products or product and service delivery. Malicious code, viruses or vulnerabilities that are undetected by our service providers may disrupt our business operations generally and may have a disproportionate effect on those of our products that are developed and delivered in the cloud environment. These risks, though largely outside our control, may impact customer perception of our products, service and support, and may damage our brand. While we devote resources to maintaining the security and integrity of our products and systems, as well as ensuring adequate due diligence for our third-party service providers, cloud security and reliability is inherently challenging. In the event of a material breach of data hosted by our service providers or a serious security incident on behalf of, caused by or experienced by a service provider, we may experience significant operational and technical difficulties, loss of data including customer data, diminished competitive position or reputation, and loss of customer engagement, which could result in civil liabilities and a negative impact to financial performance.

Financial Risks

Our revenue is subject to increased volatility due to the adoption of a new revenue recognition accounting standard on January 1, 2018.

In May 2014, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update No. 2014-09, *Revenue from Contracts with Customers (Topic 606)* (ASU 2014-09). We adopted ASU 2014-09 and its related amendments (collectively known as Accounting Standards Codification (ASC) 606) on January 1, 2018 which significantly impacted the timing, allocation and presentation of our lease license, perpetual license and maintenance revenue. Under previous revenue guidance, revenue was recognized ratably from the sale of software lease licenses and software maintenance subscriptions. However, under ASC 606, the license component of lease revenue is recognized up front. The post-contract support portion of lease license contracts continues to be recognized over the contract term, but it is now allocated to maintenance and service revenue.

We continue to sell perpetual licenses that involve the payment of a single, upfront fee. Historically, these licenses have been more typical in the computer software industry and remain as the preferred licensing approach in certain markets. The revenue associated with perpetual licenses continues to be recognized up front, consistent with prior revenue guidance.

The adoption of this revenue recognition guidance, coupled with our continued sales of perpetual licenses, creates the likelihood for software license revenue volatility to increase across periods, particularly as compared to our results under the previous revenue recognition standard. Our revenue in any period will depend significantly on sales contracts completed during that period.

Changes in existing financial accounting standards could adversely impact our financial results and operations.

Changes in existing accounting rules or practices, new accounting pronouncements, or varying interpretations of current accounting pronouncements could have a significant adverse effect on our results of operations or the manner in which we conduct our business.

In addition, we could incur significant costs for changes to our business systems, processes and internal controls as a result of the transition. These costs could have a significant adverse impact on our results of operations and cash flows. The transition could also cause management to divert time from day-to-day operations, which could impact our business. If we are unable to successfully transition our business systems, processes and internal controls before the guidance effective date, it could impact our ability to meet financial reporting deadlines. For further information on the impact of recently issued accounting guidance, see Note 2 to the consolidated financial statements included in Part IV, Item 15 of this Annual Report on Form 10-K.

Changes to tax laws, variable tax estimates and tax authority audits could impact our financial results and operations.

Our operations are subject to income and transaction taxes in the U.S. and in multiple foreign jurisdictions. A change in the tax law in the jurisdictions in which we do business, including an increase in tax rates, an adverse change in the treatment of an item of income or expense, or a decrease in tax rates in a jurisdiction in which we have significant deferred tax assets, could result in a material increase in tax expense. Furthermore, we have recorded significant deferred tax liabilities related to acquired intangible assets that are not deductible for tax purposes. These deferred tax liabilities are based on future statutory tax rates in the locations in which the intangible assets are recorded. Any future changes in statutory tax rates would be recorded as an adjustment to the deferred tax liabilities in the period the change is announced and could have a material impact on our effective tax rate during that period.

We also make significant estimates in determining our worldwide income tax provision. These estimates involve complex tax regulations in many jurisdictions and are subject to many transactions and calculations in which the ultimate tax outcome is uncertain. The outcome of tax matters could be different than the estimates reflected in the historical income tax provision and related accruals. Such differences could have a material impact on income tax expense and net income in the periods in which such determinations are made.

The amount of income tax we pay is subject to ongoing audits by federal, state and foreign tax authorities. These audits can result in additional assessments, including interest and penalties. Our estimates for liabilities associated with uncertain tax positions is highly judgmental and actual future outcomes may result in favorable or unfavorable adjustments to our estimated tax liabilities, including estimates for uncertain tax positions, in the period the assessments are made or resolved, audits are closed or when statutes of limitation on potential assessments expire. As a result, our effective tax rate may fluctuate significantly on a quarterly or annual basis.

Our indebtedness could adversely affect our business, financial condition and results of operations.

In connection with our acquisition of LST, we borrowed \$500.0 million under a term loan facility which matures on November 1, 2024. We also have access to a \$500.0 million revolving credit facility, which includes a \$50.0 million sublimit for the issuance of letters of credit. The credit agreement governing these loans contains customary representations and warranties, affirmative and negative covenants and events of default. The credit agreement also contains a financial covenant requiring us

to maintain a consolidated leverage ratio of indebtedness to earnings before interest, taxes, depreciation and amortization not exceeding 3.50 to 1.00 as of the end of any fiscal quarter (for the four-quarter period ending on such date) with an opportunity for a temporary increase in such consolidated leverage ratio to 4.00 to 1.00 upon the consummation of certain qualified acquisitions for which the aggregate consideration is at least \$250.0 million.

Notwithstanding the limits contained in the credit agreement governing our credit facility, we may be able to incur substantial additional debt from time to time to finance working capital, capital expenditures, share repurchases, investments or acquisitions, or for other purposes. If we do so, the risks related to our level of debt could intensify. Specifically, our level of debt could:

- make it more difficult for us to satisfy our debt obligations and other ongoing business obligations, which may result in defaults;
- result in an event of default if we fail to comply with the financial and other covenants contained in the agreement governing our debt, which could result in all of our debt becoming immediately due and payable or require us to negotiate an amendment to financial or other covenants that could cause us to incur additional fees and expenses;
- limit our ability to obtain additional financing to fund future working capital, capital expenditures, acquisitions or other general corporate requirements;
- reduce the availability of our cash flow to fund working capital, capital expenditures, acquisitions and other general corporate purposes;
- increase our vulnerability to the impact of adverse economic and industry conditions;
- expose us to the risk of increased interest rates as certain of our borrowings, including borrowings under the credit facility, are at variable rates of interest;
- limit our flexibility in planning for, or reacting to, and increasing our vulnerability to, changes in our business, the industries in which we operate, and the overall economy;
- place us at a competitive disadvantage compared to other, less leveraged competitors; and
- increase our cost of borrowing.

Any of the above-listed factors could have an adverse effect on our business, financial condition and results of operations and our ability to meet our payment obligations under our debt agreements.

Furthermore, borrowings under the credit agreement use the London Interbank Offering Rate (LIBOR) as a benchmark for establishing the interest rate. LIBOR has been the subject of recent national, international and other regulatory guidance and proposals for reform, and the financial industry is currently transitioning away from LIBOR as a benchmark for the interbank lending market. The consequences of these developments cannot be entirely predicted but could include an increase in the cost of our variable rate indebtedness.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

Our executive offices and those related to certain domestic product development, marketing, production and administration are located in a LEED certified, 186,000 square foot office facility in Canonsburg, Pennsylvania. The lease for this facility was effective as of September 14, 2012 and expires on December 31, 2029, excluding any renewal or termination options.

We own: a 70,000 square foot office facility in Lebanon, New Hampshire; a 62,000 square foot office building near our current Canonsburg headquarters; a 59,000 square foot facility in Pune, India; a 40,000 square foot campus in Livermore, California; and a 5,000 square foot facility in Apex, North Carolina.

We also lease office space in various locations throughout the world. We own substantially all equipment used in our facilities. Management believes that, in most geographic locations, our facilities allow for sufficient space to support present and future

foreseeable needs, including such expansion and growth as the business may require. In other geographic locations, we expect that we will be required to expand capacity beyond that which we currently own or lease.

Our properties and equipment are in good operating condition and are adequate for our current needs. We do not anticipate difficulty in renewing existing leases as they expire or in finding alternative facilities.

ITEM 3. LEGAL PROCEEDINGS

We are subject to various investigations, claims and legal proceedings that arise in the ordinary course of business, including commercial disputes, labor and employment matters, tax audits, alleged infringement of intellectual property rights and other matters. In our opinion, the resolution of pending matters is not expected to have a material adverse effect on our consolidated results of operations, cash flows or financial position. However, each of these matters is subject to various uncertainties and it is possible that an unfavorable resolution of one or more of these proceedings could materially affect our results of operations, cash flows or financial position.

ITEM 4. MINE SAFETY DISCLOSURES

Not applicable.

PART II

ITEM 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

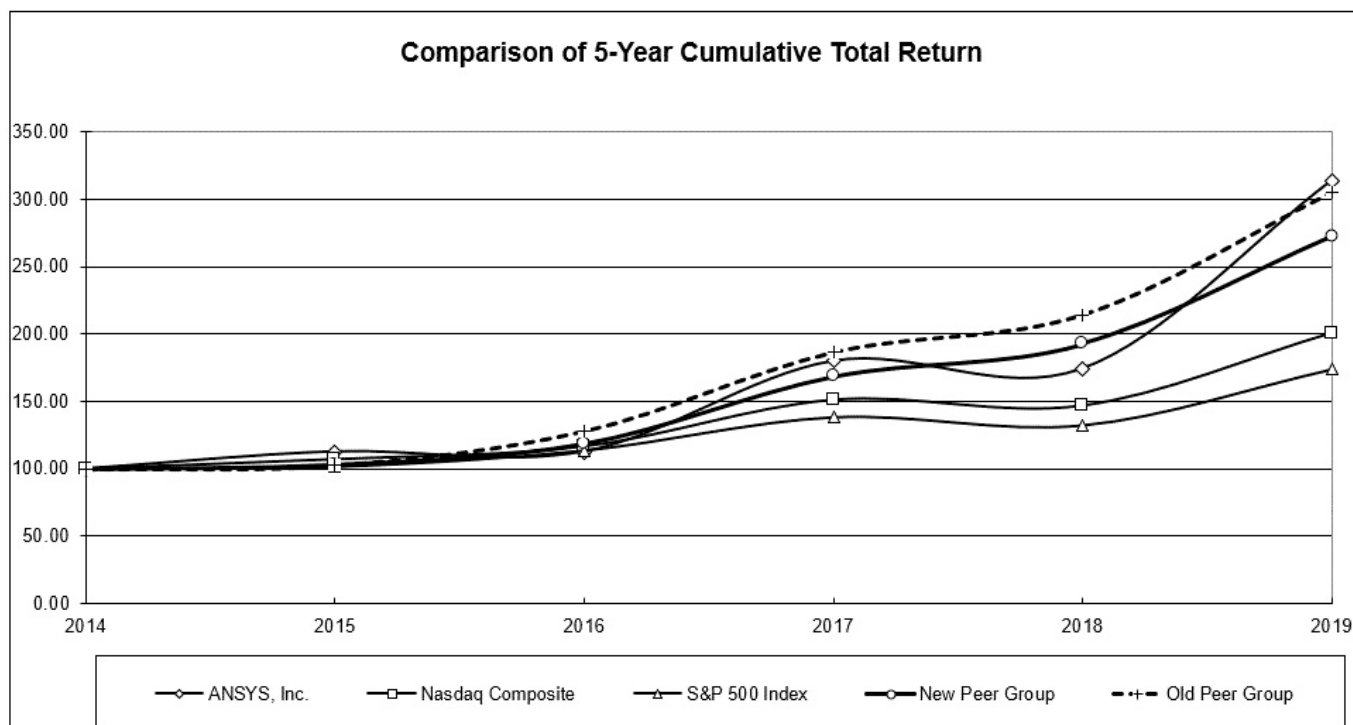
Our common stock trades on the Nasdaq Global Select Market tier of the Nasdaq Stock Market under the symbol: "ANSS".

On February 14, 2020, there were 126 stockholders of record.

We have not historically paid cash dividends on our common stock as we have retained earnings primarily for acquisitions, for future business opportunities, to make payments on outstanding debt balances and to repurchase stock when authorized by the Board of Directors and when such repurchase meets our objectives. We review our policy with respect to the payment of dividends from time to time; however, there can be no assurance that any dividends will be paid in the future.

Performance Graph

Set forth below is a line graph comparing the yearly percentage change in the cumulative total stockholder return of our common stock, based on the market price per share of our common stock, with the total return of companies included within the Nasdaq Composite Stock Market Index, the S&P 500 Stock Index, a new industry peer group of seven companies (Autodesk, Inc., PTC Inc., Cadence Design Systems, Inc., Synopsys, Inc., Altair Engineering Inc., Aspen Technology, Inc. and Dassault Systemes SE) and an old industry peer group of four companies (Autodesk, Inc., PTC Inc., Cadence Design Systems, Inc. and Synopsys, Inc.), for the period commencing December 31, 2014 and ending December 31, 2019. The calculation of total cumulative returns assumes a \$100 investment in our common stock, the Nasdaq Composite Stock Market Index, the S&P 500 Stock Index, the new peer group and the old peer group on December 31, 2014, and the reinvestment of all dividends, and accounts for all stock splits. The historical information set forth below is not necessarily indicative of future performance.



ASSUMES \$100 INVESTED ON DECEMBER 31, 2014

ASSUMES DIVIDENDS REINVESTED

FIVE FISCAL YEARS ENDED DECEMBER 31, 2019

	As of December 31,					
	2014	2015	2016	2017	2018	2019
ANSYS, Inc.	\$100	\$113	\$113	\$180	\$174	\$314
Nasdaq Composite	\$100	\$107	\$116	\$151	\$147	\$200
S&P 500 Stock Index	\$100	\$101	\$114	\$138	\$132	\$174
New Peer Group⁽¹⁾	\$100	\$103	\$119	\$169	\$193	\$273
Old Peer Group	\$100	\$103	\$128	\$187	\$214	\$305

⁽¹⁾ The new peer group is inclusive of the old peer group plus three companies added in 2019 (Altair Engineering Inc., Aspen Technology, Inc. and Dassault Systemes SE). The companies were added to enhance the comparability of the peer group to our size and business.

Unregistered Sale of Equity Securities and Use of Proceeds

None.

Issuer Purchases of Equity Securities

None.

ITEM 6. SELECTED FINANCIAL DATA

The following table sets forth selected financial data as of and for the year ended December 31 for each of the last five years. This selected financial data should be read in conjunction with the consolidated financial statements and related notes included in Part IV, Item 15 of this Annual Report on Form 10-K.

<i>(in thousands, except per share data)</i>	Year Ended December 31,				
	2019 ⁽¹⁾	2018 ⁽²⁾	2017	2016	2015
Total revenue	\$ 1,515,892	\$ 1,293,636	\$ 1,095,250	\$ 988,465	\$ 942,753
Operating income	515,040	476,574	390,728	376,242	353,679
Net income	451,295	419,375	259,251	265,636	252,521
Earnings per share – basic	\$ 5.36	\$ 4.99	\$ 3.05	\$ 3.05	\$ 2.82
Weighted average shares – basic	84,259	83,973	84,988	87,227	89,561
Earnings per share – diluted	\$ 5.25	\$ 4.88	\$ 2.98	\$ 2.99	\$ 2.76
Weighted average shares – diluted	85,925	85,913	86,854	88,969	91,502
Total assets	\$ 4,838,887	\$ 3,265,964	\$ 2,941,623	\$ 2,800,526	\$ 2,729,904
Working capital	860,340	786,410	661,713	630,301	592,280
Long-term liabilities	690,368	91,650	87,239	53,021	51,331
Stockholders' equity	3,453,379	2,649,547	2,245,831	2,208,405	2,194,427
Cash provided by operating activities ⁽³⁾	499,936	484,988	427,660	365,980	375,699

⁽¹⁾Effective January 1, 2019, we adopted new guidance on leases. We elected to adopt the change in accounting principle using the modified retrospective approach. Results for reporting periods beginning after January 1, 2019 are presented under the new guidance, while prior period amounts are not adjusted and continue to be reported in accordance with previous guidance (ASC 840). For further information, see Note 2 to the consolidated financial statements included in Part IV, Item 15 of this Annual Report on Form 10-K.

⁽²⁾Effective January 1, 2018, we adopted new guidance on revenue recognition. We elected to adopt the change in accounting principle using the modified retrospective approach. Results for reporting periods beginning after January 1, 2018 are presented under the new guidance, while prior period amounts are not adjusted and continue to be reported in accordance with previous guidance. For further information, see Note 3 to the consolidated financial statements included in Part IV, Item 15 of this Annual Report on Form 10-K.

⁽³⁾During fiscal year 2019, we retrospectively adopted new guidance on the accounting for costs incurred to implement a cloud computing arrangement (CCA) that is a service arrangement. As a result of the adoption, operating cash flows decreased with a corresponding increase to investing cash flows by \$2.5 million, \$1.4 million and \$2.8 million for the years ending December 31, 2019, 2018 and 2017, respectively. The adoption had no impact on our consolidated balance sheets or consolidated statements of income. Fiscal years 2016 and 2015 have not been restated in the table above. For further information, see Note 2 to the consolidated financial statements included in Part IV, Item 15 of this Annual Report on Form 10-K.

In the table above, the comparability of information among the years presented is impacted by our acquisitions. The operating results of our acquisitions have been included in the results of operations since their respective acquisition dates. For further information, see the “Acquisitions” section of Management's Discussion and Analysis of Financial Condition and Results of Operations in Item 7 and Note 4 to the consolidated financial statements included in Part IV, Item 15 of this Annual Report on Form 10-K.

ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

Overview

Overall GAAP and Non-GAAP Results

Our growth rates of GAAP and non-GAAP results for the year ended December 31, 2019 as compared to the year ended December 31, 2018 were as follows:

	Year Ended December 31, 2019	
	GAAP	Non-GAAP
Revenue	17.2%	17.3%
Operating income	8.1%	12.0%
Diluted earnings per share	7.6%	10.0%

We experienced higher revenue during the year ended December 31, 2019 from double-digit growth in lease licenses, maintenance and service, partially driven by contributions from our recent acquisitions. We also experienced increased operating expenses primarily due to increased personnel costs, higher stock-based compensation and additional operating expenses related to acquisitions, partially offset by a reduction in expenses due to a stronger U.S. Dollar.

The non-GAAP results exclude the income statement effects of the acquisition accounting adjustments to deferred revenue, stock-based compensation, amortization of acquired intangible assets, transaction costs related to business combinations, and adjustments related to the transition tax associated with the Tax Cuts and Jobs Act. For further disclosure regarding non-GAAP results, see the section titled "Non-GAAP Results" immediately preceding the section titled "Liquidity and Capital Resources."

Impact of Foreign Currency

Our comparative financial results were impacted by fluctuations in the U.S. Dollar during the year ended December 31, 2019 as compared to the year ended December 31, 2018. The impacts on our revenue and operating income due to currency fluctuations are reflected in the table below. Amounts in brackets indicate an adverse impact from currency fluctuations.

<i>(in thousands)</i>	Year Ended December 31, 2019	
	GAAP	Non-GAAP
Revenue	\$ (24,008)	\$ (24,235)
Operating income	\$ (10,213)	\$ (11,062)

In constant currency, our growth rates were as follows:

	Year Ended December 31, 2019	
	GAAP	Non-GAAP
Revenue	19.0%	19.2%
Operating income	10.2%	13.8%

Constant currency amounts exclude the effects of foreign currency fluctuations on the reported results. To present this information, the 2019 results for entities whose functional currency is a currency other than the U.S. Dollar were converted to U.S. Dollars at rates that were in effect for the 2018 comparable period, rather than the actual exchange rates in effect for 2019. Constant currency growth rates are calculated by adjusting the 2019 reported revenue and operating income amounts by the 2019 currency fluctuation impacts and comparing to the 2018 comparable period reported revenue and operating income amounts.

Other Financial Information

Our financial position includes \$872.4 million in cash and short-term investments, and working capital of \$860.3 million as of December 31, 2019.

During the year ended December 31, 2019, we repurchased 0.3 million shares for \$59.1 million at an average price of \$179.41 per share under our stock repurchase program.

Business

Ansys, a Delaware corporation formed in 1994, develops and globally markets engineering simulation software and services widely used by engineers, designers, researchers and students across a broad spectrum of industries and academia, including aerospace and defense, automotive, electronics, semiconductors, energy, materials and chemical processing, turbomachinery, consumer products, healthcare, and sports. Headquartered south of Pittsburgh, Pennsylvania, we employed approximately 4,100 people as of December 31, 2019. We focus on the development of open and flexible solutions that enable users to analyze designs directly on the desktop, providing a common platform for fast, efficient and cost-conscious product development, from design concept to final-stage testing and validation. We distribute our suite of simulation technologies through a global network of independent resellers and distributors (collectively, channel partners) and direct sales offices in strategic, global locations. It is our intention to continue to maintain this hybrid sales and distribution model.

We license our technology to businesses, educational institutions and governmental agencies. Growth in our revenue is affected by the strength of global economies, general business conditions, currency exchange rate fluctuations, customer budgetary constraints and the competitive position of our products. Please see Part I. Item 1A. of this Annual Report on Form 10-K for a complete discussion of factors that might impact our financial condition and operating results. We believe that the features, functionality and integrated multiphysics capabilities of our software products are as strong as they have ever been. However, the software business is generally characterized by long sales cycles. These long sales cycles increase the difficulty of predicting sales for any particular quarter. We make many operational and strategic decisions based upon short- and long-term sales forecasts that are impacted not only by these long sales cycles, but also by current global economic conditions. As a result, we believe that our overall performance is best measured by fiscal year results rather than by quarterly results. Please see the sub-section entitled "Financial Risks" under Part I. Item 1A. of this Annual Report on Form 10-K for additional discussion of the potential impact of our sales forecasts on our financial condition, cash flows and operating results.

Management considers the competition and price pressure that it faces in the short- and long-term by focusing on expanding the breadth, depth, ease of use and quality of the technologies, features, functionality and integrated multiphysics capabilities of our software products as compared to our competitors; investing in research and development to develop new and innovative products and increase the capabilities of our existing products; supplying new products and services; focusing on customer needs, training, consulting and support; and enhancing our distribution channels. We also consider acquisitions to supplement our global engineering talent, product offerings and distribution channels.

Geographic Trends

The following table presents our geographic constant currency revenue growth during the year ended December 31, 2019 as compared to the year ended December 31, 2018:

	Year Ended December 31, 2019
Americas	25.4%
Europe, Middle East and Africa (EMEA)	13.8%
Asia-Pacific	15.6%
Total	19.0%

We continue to focus on a number of sales improvement activities across the geographic regions, including sales hiring, pipeline building, productivity initiatives and customer engagement activities.

As trade tensions between the U.S. and China continue, as well as the uncertainty around China's ability to control the coronavirus outbreak, our ability to sell and ship our products to certain customers and our ability to collect against existing trade receivables may be further restricted and could have an adverse effect on our business, results of operations or financial condition. For additional details, refer to Part I. Item 1A. of this Annual Report on Form 10-K.

Industry Commentary:

Our three largest industries — high-tech, automotive, and aerospace and defense (A&D) — remained strong throughout 2019. The high-tech industry was positively impacted by companies' investments in 5G and smart connected products. The automotive industry continued its momentum due to continued investments by our customers to capture the disruptive mobility trends of autonomy and electrification. Defense spending continued to support growth in the aerospace and defense industry.

Acquisitions

On November 1, 2019, we completed the acquisition of 100% of the shares of LST, the premier provider of explicit dynamics and other advanced finite element analysis technology, for a purchase price of \$777.8 million. The acquisition empowers our customers to solve a new class of engineering challenges, including developing safer automobiles, aircraft and trains while reducing or even eliminating the need for costly physical testing.

On February 1, 2019, we completed the acquisition of 100% of the shares of Granta Design, the premier provider of materials information technology, for a purchase price of \$208.7 million. The acquisition expands our portfolio into this important area, giving customers access to materials intelligence, including data that is critical to successful simulations.

Additionally, during the year ended December 31, 2019, we acquired Dynardo, Helic and DfR Solutions to combine the acquired technologies with our existing comprehensive multiphysics portfolio. These acquisitions were not individually significant. The combined purchase price of these acquisitions was \$136.2 million.

During the year ended December 31, 2018, we completed the acquisition of 100% of the shares of OPTIS, a premier provider of software for scientific simulation of light, human vision and physics-based visualization, for a purchase price of \$291.0 million. The acquisition extended our portfolio into the area of optical simulation to provide comprehensive sensor solutions, covering visible and infrared light, electromagnetics and acoustics for camera, radar and lidar.

During the year ended December 31, 2017, we completed various acquisitions to expand our customer base and accelerate the development of new and innovative products to the marketplace while lowering design and engineering costs for customers. The acquisitions were not individually significant. The combined purchase price of the acquisitions was approximately \$67.0 million.

For further information on our business combinations during the years ended December 31, 2019, 2018 and 2017, see Note 4 to the consolidated financial statements included in Part IV, Item 15 of this Annual Report on Form 10-K.

Results of Operations

For purposes of the following discussion and analysis, the table below sets forth certain consolidated financial data for the years 2019, 2018 and 2017. The operating results of our acquisitions have been included in the results of operations since their respective acquisition dates.

<i>(in thousands)</i>	Year Ended December 31,		
	2019	2018	2017
Revenue:			
Software licenses	\$ 699,630	\$ 576,717	\$ 624,964
Maintenance and service	816,262	716,919	470,286
Total revenue	<u>1,515,892</u>	<u>1,293,636</u>	<u>1,095,250</u>
Cost of sales:			
Software licenses	23,944	18,619	34,421
Amortization	21,710	27,034	36,794
Maintenance and service	120,619	110,232	78,949
Total cost of sales	<u>166,273</u>	<u>155,885</u>	<u>150,164</u>
Gross profit	<u>1,349,619</u>	<u>1,137,751</u>	<u>945,086</u>
Operating expenses:			
Selling, general and administrative	521,200	413,580	338,640
Research and development	298,210	233,802	202,746
Amortization	15,169	13,795	12,972
Total operating expenses	<u>834,579</u>	<u>661,177</u>	<u>554,358</u>
Operating income	<u>515,040</u>	<u>476,574</u>	<u>390,728</u>
Interest income	12,796	11,419	6,962
Interest expense	(3,461)	(59)	(86)
Other expense, net	(1,792)	(849)	(1,910)
Income before income tax provision	<u>522,583</u>	<u>487,085</u>	<u>395,694</u>
Income tax provision	<u>71,288</u>	<u>67,710</u>	<u>136,443</u>
Net income	<u>\$ 451,295</u>	<u>\$ 419,375</u>	<u>\$ 259,251</u>

Effective January 1, 2018, we adopted new guidance on revenue recognition. We elected to adopt the change in accounting principle using the modified retrospective approach. Results for reporting periods beginning after January 1, 2018 are presented under the new guidance, while prior period amounts are not adjusted and continue to be reported in accordance with previous guidance. For further information, see Note 3 to the consolidated financial statements included in Part IV, Item 15 of this Annual Report on Form 10-K.

Year Ended December 31, 2019 Compared to Year Ended December 31, 2018

Revenue:

<i>(in thousands, except percentages)</i>	Year Ended December 31,		Change		Constant Currency %
	2019	2018	Amount	%	
Revenue:					
Lease licenses	\$ 406,043	\$ 275,619	\$ 130,424	47.3	49.4
Perpetual licenses	293,587	301,098	(7,511)	(2.5)	(1.1)
Software licenses	699,630	576,717	122,913	21.3	23.1
Maintenance	760,574	676,883	83,691	12.4	14.3
Service	55,688	40,036	15,652	39.1	41.5
Maintenance and service	816,262	716,919	99,343	13.9	15.8
Total revenue	\$ 1,515,892	\$ 1,293,636	\$ 222,256	17.2	19.0

Our revenue in the year ended December 31, 2019 increased 17.2% as compared to the year ended December 31, 2018, or 19.0% in constant currency. The growth rate was favorably impacted by our continued investments in our global sales, support and marketing organizations, as well as our 2019 and 2018 acquisitions which contributed incremental revenue of \$72.9 million. Lease license revenue increased 47.3%, or 49.4% in constant currency, as compared to the year ended December 31, 2018, driven primarily by an increase in multi-year lease contracts. Annual maintenance contracts that were sold with new perpetual licenses, maintenance contracts for new perpetual licenses sold in previous years and the maintenance portion of lease license contracts each contributed to maintenance revenue growth of 12.4%, or 14.3% in constant currency. Service revenue, driven primarily by a focus on service offerings that provide on-site mentorship on simulation best practices, training and expanding simulation adoption, increased 39.1%, or 41.5% in constant currency, as compared to the year ended December 31, 2018. Perpetual license revenue, which is derived primarily from new sales during the year ended December 31, 2019, decreased 2.5%, or 1.1% in constant currency, as compared to the year ended December 31, 2018.

We continue to experience increased interest by some of our larger customers in enterprise agreements that often include longer-term, time-based licenses involving a larger number of our software products. While these arrangements typically involve a higher overall transaction price, the upfront recognition of license revenue related to these larger, multi-year transactions can result in significantly higher lease license revenue and corresponding revenue growth volatility. As software products, across a large variety of applications and industries, become increasingly distributed in software-as-a-service, cloud and other subscription environments in which the licensing approach is time-based rather than perpetual, we are also experiencing a shifting preference from perpetual licenses to time-based licenses across a broader spectrum of our customers.

With respect to revenue, on average for the year ended December 31, 2019, the U.S. Dollar was approximately 3.3% stronger, when measured against our primary foreign currencies, than for the year ended December 31, 2018. The table below presents the impacts of currency fluctuations on revenue for the year ended December 31, 2019. Amounts in brackets indicate an adverse impact from currency fluctuations.

<i>(in thousands)</i>	Year Ended December 31, 2019
Euro	\$ (17,361)
South Korean Won	(5,097)
British Pound	(1,881)
Japanese Yen	1,791
Other	(1,460)
Total	\$ (24,008)

The net overall stronger U.S. Dollar also resulted in decreased operating income of \$10.2 million for the year ended December 31, 2019 as compared to the year ended December 31, 2018.

As a percentage of revenue, our international and domestic revenues, and our direct and indirect revenues, were as follows:

	Year Ended December 31,	
	2019	2018
International	57.9%	60.9%
Domestic	42.1%	39.1%
Direct	77.1%	77.6%
Indirect	22.9%	22.4%

In valuing deferred revenue on the balance sheets of our recent acquisitions as of their respective acquisition dates, we applied the fair value provisions applicable to the accounting for business combinations, resulting in a reduction of deferred revenue as compared to the historical carrying amount. As a result, our post-acquisition revenue will be less than the sum of what would have otherwise been reported by us and each acquiree absent the acquisitions. The impacts on reported revenue were \$12.5 million and \$9.4 million for the years ended December 31, 2019 and 2018, respectively. The expected impacts on reported revenue are \$3.9 million and \$8.0 million for the quarter ending March 31, 2020 and the year ending December 31, 2020, respectively.

Cost of Sales and Operating Expenses:

The tables below reflect our operating results as presented on the consolidated statements of income, which are inclusive of foreign currency translation impacts. Amounts included in the discussions that follow each table are provided in constant currency and are inclusive of costs related to our acquisitions. The impact of foreign exchange translation is discussed separately, where material. The 2019 and 2018 acquisitions contributed \$54.7 million to the overall increase in cost of sales and operating expenses with the most significant contributions from the OPTIS (May 2, 2018) and Granta Design (February 1, 2019) acquisitions of \$17.3 million and \$18.9 million, respectively.

(in thousands, except percentages)	Year Ended December 31,				Change	
	2019		2018		Amount	%
	Amount	% of Revenue	Amount	% of Revenue		
Cost of sales:						
Software licenses	\$ 23,944	1.6	\$ 18,619	1.4	\$ 5,325	28.6
Amortization	21,710	1.4	27,034	2.1	(5,324)	(19.7)
Maintenance and service	120,619	8.0	110,232	8.5	10,387	9.4
Total cost of sales	166,273	11.0	155,885	12.1	10,388	6.7
Gross profit	\$ 1,349,619	89.0	\$ 1,137,751	87.9	\$ 211,868	18.6

Software Licenses: The increase in the cost of software licenses was primarily due to increased third-party royalties of \$5.6 million.

Amortization: The net decrease in amortization expense was primarily due to a decrease in the amortization of trade names and acquired technology due to assets that became fully amortized, which was partially offset by the amortization of newly acquired intangible assets.

Maintenance and Service: The net increase in maintenance and service costs was primarily due to the following:

- Increased salaries of \$4.0 million.
- Increased stock-based compensation of \$3.3 million.
- Increased consulting costs of \$1.7 million.
- Increased IT maintenance and software hosting costs of \$1.3 million.
- Decreased costs related to foreign exchange translation of \$2.0 million due to a stronger U.S. Dollar.

The improvement in gross profit was a result of the increase in revenue, partially offset by the increase in the related cost of sales.

<i>(in thousands, except percentages)</i>	Year Ended December 31,				Change	
	2019		2018		Amount	%
	Amount	% of Revenue	Amount	% of Revenue		
Operating expenses:						
Selling, general and administrative	\$ 521,200	34.4	\$ 413,580	32.0	\$ 107,620	26.0
Research and development	298,210	19.7	233,802	18.1	64,408	27.5
Amortization	15,169	1.0	13,795	1.1	1,374	10.0
Total operating expenses	\$ 834,579	55.1	\$ 661,177	51.1	\$ 173,402	26.2

Selling, General and Administrative: The net increase in selling, general and administrative costs was primarily due to the following:

- Increased salaries, incentive compensation and other headcount-related costs of \$63.7 million.
- Increased stock-based compensation of \$13.5 million.
- Increased business travel of \$6.5 million.
- Increased marketing expenses of \$5.4 million.
- Increased professional fees of \$4.5 million.
- Increased consulting costs of \$4.2 million.
- Decreased costs related to foreign exchange translation of \$7.1 million due to a stronger U.S. Dollar.

We anticipate that we will continue to make targeted investments in our global sales and marketing organizations and our global business infrastructure to enhance and support our revenue-generating activities.

Research and Development: The increase in research and development costs was primarily due to the following:

- Increased salaries, incentive compensation and other headcount-related costs of \$41.1 million.
- Increased stock-based compensation of \$16.0 million.

We have traditionally invested significant resources in research and development activities and intend to continue to make investments in expanding the ease of use and capabilities of our broad portfolio of simulation software products.

Interest Income: Interest income for the year ended December 31, 2019 was \$12.8 million as compared to \$11.4 million for the year ended December 31, 2018. Interest income increased as a result of an increase in the average rate of return on invested cash balances.

Interest Expense: Interest expense for the year ended December 31, 2019 was \$3.5 million as compared to \$0.1 million for the year ended December 31, 2018. Interest expense increased as a result of the interest incurred on debt financing obtained in fiscal year 2019.

Other Expense, net: Our other expense consisted of the following:

<i>(in thousands)</i>	Year Ended December 31,	
	2019	2018
Foreign currency losses, net	\$ (2,510)	\$ (3,058)
Investment gains, net	333	2,204
Other	385	5
Total other expense, net	\$ (1,792)	\$ (849)

Income Tax Provision: Our income before income tax provision, income tax provision and effective tax rate were as follows:

<i>(in thousands, except percentages)</i>	Year Ended December 31,	
	2019	2018
Income before income tax provision	\$ 522,583	\$ 487,085
Income tax provision	\$ 71,288	\$ 67,710
Effective tax rate	13.6%	13.9%

The decrease in the effective tax rate from the prior year was primarily due to \$6.7 million of benefit related to the release of valuation allowance in a foreign jurisdiction and \$1.8 million of benefit related to transition tax recorded in 2019. These benefits are offset by \$6.7 million of benefit recorded in 2018 related to global legal entity restructuring activities that did not recur in 2019.

When compared to the federal and state combined statutory rate for each respective period, the effective tax rates for the years ended December 31, 2019 and 2018 were favorably impacted by tax benefits from stock-based compensation, the foreign-derived intangible income deduction, and research and development credits.

Net Income: Our net income, diluted earnings per share and weighted average shares used in computing diluted earnings per share were as follows:

<i>(in thousands, except per share data)</i>	Year Ended December 31,	
	2019	2018
Net income	\$ 451,295	\$ 419,375
Diluted earnings per share	\$ 5.25	\$ 4.88
Weighted average shares outstanding - diluted	85,925	85,913

Year Ended December 31, 2018 Compared to Year Ended December 31, 2017

Revenue:

<i>(in thousands, except percentages)</i>	Year Ended December 31,		Change		
	2018 (ASC 606)	2017 (ASC 605)	Amount	%	Constant Currency %
Revenue:					
Lease licenses	\$ 275,619	\$ 376,886	\$ (101,267)	(26.9)	(27.4)
Perpetual licenses	301,098	248,078	53,020	21.4	20.2
Software licenses	576,717	624,964	(48,247)	(7.7)	(8.5)
Maintenance	676,883	440,428	236,455	53.7	51.6
Service	40,036	29,858	10,178	34.1	33.1
Maintenance and service	716,919	470,286	246,633	52.4	50.4
Total revenue	\$ 1,293,636	\$ 1,095,250	\$ 198,386	18.1	16.8

The adoption of ASC 606 significantly impacted the timing, allocation and presentation of lease license, perpetual license and maintenance revenue. For further information about this adoption, see Note 3 to the consolidated financial statements included in Part IV, Item 15 of this Annual Report on Form 10-K.

For purposes of comparability, the changes in the following table and the related discussion that follows are presented in accordance with ASC 605.

<i>(in thousands, except percentages)</i>	Year Ended December 31,		Change		
	2018 (ASC 605)	2017 (ASC 605)	Amount	%	Constant Currency %
Revenue:					
Lease licenses	\$ 421,268	\$ 376,886	\$ 44,382	11.8	10.7
Perpetual licenses	255,578	248,078	7,500	3.0	2.0
Software licenses	676,846	624,964	51,882	8.3	7.2
Maintenance	499,510	440,428	59,082	13.4	11.6
Service	40,113	29,858	10,255	34.3	33.4
Maintenance and service	539,623	470,286	69,337	14.7	13.0
Total revenue	\$ 1,216,469	\$ 1,095,250	\$ 121,219	11.1	9.7

Our ASC 605 revenue in the year ended December 31, 2018 increased 11.1% as compared to the year ended December 31, 2017, while revenue grew 9.7% in constant currency. The growth rate was favorably impacted by our continued investments in our global sales, support and marketing organizations; continued progress with market segmentation and go-to-market adjustments; and the May 2018 acquisition of OPTIS. Lease license revenue increased 11.8%, or 10.7% in constant currency, as compared to the year ended December 31, 2017. Perpetual license revenue, which is derived primarily from new sales during the year, increased 3.0%, or 2.0% in constant currency, as compared to the year ended December 31, 2017. Annual maintenance contracts that were sold with new perpetual licenses, along with maintenance contracts for perpetual licenses sold in previous years, contributed to maintenance revenue growth of 13.4%, or 11.6% in constant currency. Service revenue, driven primarily by a focus on service offerings that provide on-site mentorship on simulation best practices, training and expanding simulation adoption, increased 34.3%, or 33.4% in constant currency, as compared to the year ended December 31, 2017.

With respect to revenue, on average for the year ended December 31, 2018, the U.S. Dollar was approximately 2.3% weaker and 2.6% weaker, when measured against our primary foreign currencies, than for the year ended December 31, 2017 under ASC 606 and ASC 605, respectively. The table below presents the impacts of currency fluctuations on revenue for the year ended December 31, 2018. Amounts in brackets indicate a net adverse impact from currency fluctuations.

<i>(in thousands)</i>	Year Ended December 31, 2018	
	ASC 606	ASC 605
Euro	\$ 12,498	\$ 11,915
Japanese Yen	2,088	2,075
South Korean Won	918	1,182
British Pound	870	1,083
Indian Rupee	(1,623)	(1,372)
Other	(129)	(36)
Total	\$ 14,622	\$ 14,847

The net overall weaker U.S. Dollar also resulted in increased operating income of \$9.6 million and \$10.3 million for the year ended December 31, 2018 as compared to the year ended December 31, 2017 under ASC 606 and ASC 605, respectively.

As a percentage of revenue, our international and domestic revenues, and our direct and indirect revenues, were as follows:

	Year Ended December 31,		
	2018 (ASC 606)	2018 (ASC 605)	2017 (ASC 605)
International	60.9%	60.5%	61.9%
Domestic	39.1%	39.5%	38.1%
Direct	77.6%	76.5%	75.2%
Indirect	22.4%	23.5%	24.8%

In valuing deferred revenue on the balance sheets of our recent acquisitions as of their respective acquisition dates, we applied the fair value provisions applicable to the accounting for business combinations, resulting in a reduction of deferred revenue as compared to the historical carrying amount. As a result, our post-acquisition revenue will be less than the sum of what would have otherwise been reported by us and each acquiree absent the acquisitions. Under ASC 606, the impact on reported revenue was \$9.4 million for the year ended December 31, 2018. Under ASC 605, the impacts on reported revenue were \$15.6 million and \$2.9 million for the years ended December 31, 2018 and 2017, respectively.

Cost of Sales and Operating Expenses:

The tables below reflect our operating results as presented on the consolidated statements of income, which are inclusive of foreign currency translation impacts. The adoption of ASC 606 resulted in a reclassification of expenses within cost of sales from software licenses to maintenance and service. Amounts included in the discussion that follows are provided in constant currency and do not include the impact of the OPTIS acquisition. The impact of the OPTIS acquisition on each expense line is provided separately, where material. The impact, where material, of foreign exchange translation on each expense line is also provided separately and is inclusive of the OPTIS acquisition.

<i>(in thousands, except percentages)</i>	Year Ended December 31,				Change	
	2018		2017		Amount	%
	Amount	% of Revenue	Amount	% of Revenue		
Cost of sales:						
Software licenses	\$ 18,619	1.4	\$ 34,421	3.1	\$ (15,802)	(45.9)
Amortization	27,034	2.1	36,794	3.4	(9,760)	(26.5)
Maintenance and service	110,232	8.5	78,949	7.2	31,283	39.6
Total cost of sales	155,885	12.1	150,164	13.7	5,721	3.8
Gross profit	\$ 1,137,751	87.9	\$ 945,086	86.3	\$ 192,665	20.4

Software Licenses: The net decrease in the cost of software licenses was primarily due to the following:

- Reclassification of \$18.2 million of cost of sales, previously reflected within software licenses, to maintenance and service due to the adoption of ASC 606 in 2018.
- OPTIS-related software license expenses of \$1.6 million for the period from the acquisition date (May 2, 2018) through December 31, 2018.

Amortization: The decrease in amortization expense was primarily due to a net decrease in the amortization of trade names and acquired technology due to assets that became fully amortized.

Maintenance and Service: The increase in maintenance and service costs was primarily due to the following:

- Reclassification of \$18.2 million of cost of sales, previously reflected within software licenses, to maintenance and service due to the adoption of ASC 606 in 2018.
- Increased third-party technical support of \$5.5 million.
- OPTIS-related maintenance and service expenses of \$2.8 million for the period from the acquisition date (May 2, 2018) through December 31, 2018.
- Increased salaries of \$2.1 million.

The improvement in gross profit was a result of the increase in revenue, partially offset by the increase in the related cost of sales.

<i>(in thousands, except percentages)</i>	Year Ended December 31,				Change	
	2018		2017		Amount	%
	Amount	% of Revenue	Amount	% of Revenue		
Operating expenses:						
Selling, general and administrative	\$ 413,580	32.0	\$ 338,640	30.9	\$ 74,940	22.1
Research and development	233,802	18.1	202,746	18.5	31,056	15.3
Amortization	13,795	1.1	12,972	1.2	823	6.3
Total operating expenses	\$ 661,177	51.1	\$ 554,358	50.6	\$ 106,819	19.3

Selling, General and Administrative: The net increase in selling, general and administrative costs was primarily due to the following:

- Increased salaries, incentive compensation and other headcount-related costs of \$35.2 million.
- Increased stock-based compensation of \$15.3 million.
- OPTIS-related selling, general and administrative expenses of \$13.8 million for the period from the acquisition date (May 2, 2018) through December 31, 2018.
- Increased business travel of \$3.9 million.
- Increased severance expenses of \$3.7 million.
- Decreased consulting costs of \$7.1 million.

Research and Development: The net increase in research and development costs was primarily due to the following:

- Increased salaries, incentive compensation and other headcount-related costs of \$15.2 million.
- Increased stock-based compensation of \$11.6 million.
- OPTIS-related research and development expenses of \$5.9 million for the period from the acquisition date (May 2, 2018) through December 31, 2018.
- Increased IT maintenance and software hosting costs of \$1.5 million.
- Restructuring costs of \$6.8 million related to 2017 workforce realignment activities that did not reoccur in 2018.

Interest Income: Interest income for the year ended December 31, 2018 was \$11.4 million as compared to \$7.0 million for the year ended December 31, 2017. Interest income increased as a result of an increase in the average rate of return on invested cash balances.

Other Expense, net: Our other expense, net consists of the following:

<i>(in thousands)</i>	Year Ended December 31,	
	2018	2017
Foreign currency losses, net	\$ (3,058)	\$ (1,935)
Investment gains, net	2,204	24
Other	5	1
Total other expense, net	\$ (849)	\$ (1,910)

Income Tax Provision: Our income before income tax provision, income tax provision and effective tax rate were as follows:

<i>(in thousands, except percentages)</i>	Year Ended December 31,		
	2018 (ASC 606)	2018 (ASC 605)	2017 (ASC 605)
Income before income tax provision	\$ 487,085	\$ 409,918	\$ 395,694
Income tax provision	\$ 67,710	\$ 53,067	\$ 136,443
Effective tax rate	13.9%	12.9%	34.5%

On December 22, 2017, the U.S. government enacted comprehensive tax legislation commonly referred to as the Tax Cuts and Jobs Act (Tax Reform). Tax Reform made broad and complex changes to the U.S. tax code, including, but not limited to, (1) reducing the U.S. federal corporate tax rate from 35 percent to 21 percent; (2) requiring companies to pay a one-time federal income tax on certain unrepatriated earnings of foreign subsidiaries (transition tax); (3) generally eliminating U.S. federal income taxes on dividends from foreign subsidiaries; (4) creating a new provision designed to tax global intangible low-taxed income (GILTI) which allows for the possibility of using foreign tax credits (FTCs) and a deduction of up to 50 percent to offset the income tax liability (subject to some limitations); (5) repealing the domestic production activity deduction; (6) creating the foreign-derived intangible income deduction; (7) creating the base erosion anti-abuse tax, a new minimum tax; (8) allowing for full expensing of qualified property through bonus depreciation; and (9) creating limitations on the deductibility of certain executive compensation.

The SEC staff issued Staff Accounting Bulletin (SAB) 118, which provides guidance on accounting for the tax effects of Tax Reform. SAB 118 provided a measurement period that was limited to one year from enactment for companies to complete the accounting under ASC 740, *Income Taxes*. In accordance with SAB 118, throughout the measurement period, a company must reflect the income tax effects of those aspects of Tax Reform for which the accounting under ASC 740 was complete in the financial statements. To the extent that a company's accounting for certain income tax effects of Tax Reform was incomplete, but a reasonable estimate was able to be made, the company must record a provisional estimate in the financial statements. If a company could not determine a provisional estimate to be included in the financial statements, it should continue to apply ASC 740 on the basis of the tax laws that were in effect immediately before the enactment of Tax Reform.

As further discussed below, we finalized our provisional Tax Reform calculations as of the end of the measurement period, based on guidance and information available as of the reporting date. The U.S. government has not yet issued final guidance related to a portion of the new rules enacted as part of Tax Reform. Subsequent adjustments, if any, will be recorded in the period in which guidance is finalized.

Our accounting for the impact of the reduction in the U.S. federal corporate tax rate on our deferred tax assets and liabilities is complete. Tax Reform reduced the corporate tax rate to 21 percent, effective January 1, 2018. Consequently, we recorded a net adjustment to deferred income tax expense of \$1.9 million for the year ended December 31, 2017 to revalue our deferred tax assets and liabilities. No further adjustments were recorded for the year ended December 31, 2018.

Our accounting for the transition tax is complete. Reasonable estimates of certain effects were calculated and a provisional adjustment of \$16.0 million was recorded in the December 31, 2017 financial statements. To determine the amount of the transition tax, we determined, in addition to other factors, the amount of post-1986 earnings and profits (E&P) of the relevant subsidiaries, as well as the amount of non-U.S. income taxes paid on such earnings. Based on revised E&P calculations updated during the measurement period, we recognized an additional measurement-period adjustment for the year ended December 31, 2018 of \$0.9 million to the transition tax obligation and a corresponding adjustment to tax expense.

Our accounting for the indefinite reinvestment assertion is complete. In general, it is our intention to permanently reinvest all earnings in excess of previously taxed amounts. As part of Tax Reform, substantially all of the previous earnings of our non-U.S. subsidiaries were taxed through the transition tax and current earnings are taxed as part of GILTI tax expense. These taxes increased our previously taxed earnings and allow for the repatriation of the majority of our foreign earnings without any residual U.S. federal tax. During the year ended December 31, 2018, we repatriated \$144.3 million of foreign cash. We did not make any adjustments related to our indefinite reinvestment assertion during the year ended December 31, 2018.

Our accounting policy choice for GILTI is complete. Under U.S. GAAP, we are allowed to make an accounting policy choice of either (1) treating taxes due on future U.S. inclusions in taxable income related to GILTI as a current-period expense when incurred (the period cost method) or (2) factoring such amounts into the measurement of our deferred taxes (the deferred method). We selected the period cost method and recorded GILTI tax expense of \$0.4 million in the financial statements for the year ended December 31, 2018.

The decrease in the effective tax rate from the prior year was primarily due to the reduction in the U.S. federal corporate tax rate from 35 percent to 21 percent enacted as part of Tax Reform, the additional \$15.1 million of transition tax in 2017 when compared to 2018, and a net \$6.7 million benefit related to global legal entity restructuring activities. The effective tax rate was also reduced by the foreign-derived intangible income deduction, increased research and development credits and increased stock-based compensation benefits, partially offset by the loss of the domestic manufacturing deduction, which was repealed as part of Tax Reform.

When compared to the federal and state combined statutory rate, the effective tax rates for the years ended December 31, 2018 and 2017 were favorably impacted by tax benefits from stock-based compensation and research and development credits.

Net Income: Our net income, diluted earnings per share and weighted average shares used in computing diluted earnings per share were as follows:

<i>(in thousands, except per share data)</i>	Year Ended December 31,		
	2018 (ASC 606)	2018 (ASC 605)	2017 (ASC 605)
Net income	\$ 419,375	\$ 356,851	\$ 259,251
Diluted earnings per share	\$ 4.88	\$ 4.15	\$ 2.98
Weighted average shares outstanding - diluted	85,913	85,913	86,854

Non-GAAP Results

We provide non-GAAP revenue, non-GAAP operating income, non-GAAP operating profit margin, non-GAAP net income and non-GAAP diluted earnings per share as supplemental measures to GAAP regarding our operational performance. These financial measures exclude the impact of certain items and, therefore, have not been calculated in accordance with GAAP. A detailed explanation and a reconciliation of each non-GAAP financial measure to our most comparable GAAP financial measure are described below.

	ASC 606					
	Year Ended December 31,					
	2019			2018		
<i>(in thousands, except percentages and per share data)</i>	GAAP Results	Adjustments	Non-GAAP Results	GAAP Results	Adjustments	Non-GAAP Results
Total revenue	\$1,515,892	\$ 12,514 (1)	\$1,528,406	\$ 1,293,636	\$ 9,442 (4)	\$ 1,303,078
Operating income	515,040	177,093 (2)	692,133	476,574	141,442 (5)	618,016
Operating profit margin	34.0%		45.3%	36.8%		47.4%
Net income	\$ 451,295	\$ 113,702 (3)	\$ 564,997	\$ 419,375	\$ 94,510 (6)	\$ 513,885
Earnings per share – diluted:						
Earnings per share	\$ 5.25		\$ 6.58	\$ 4.88		\$ 5.98
Weighted average shares	85,925		85,925	85,913		85,913

- (1) Amount represents the revenue not reported during the period as a result of the acquisition accounting adjustment associated with the accounting for deferred revenue in business combinations.
- (2) Amount represents \$116.2 million of stock-based compensation expense, \$4.9 million of excess payroll taxes related to stock-based awards, \$36.9 million of amortization expense associated with intangible assets acquired in business combinations, \$6.6 million of transaction expenses related to business combinations and the \$12.5 million adjustment to revenue as reflected in (1) above.
- (3) Amount represents the impact of the adjustments to operating income referred to in (2) above, decreased for the related income tax impact of \$61.2 million, adjustments related to the transition tax associated with the Tax Cuts and Jobs Act of \$1.8 million, and rabbi trust income of \$0.4 million.
- (4) Amount represents the revenue not reported during the period as a result of the acquisition accounting adjustment associated with the accounting for deferred revenue in business combinations.
- (5) Amount represents \$83.3 million of stock-based compensation expense, \$4.3 million of excess payroll taxes related to stock-based awards, \$40.8 million of amortization expense associated with intangible assets acquired in business combinations, \$3.5 million of transaction expenses related to business combinations and the \$9.4 million adjustment to revenue as reflected in (4) above.
- (6) Amount represents the impact of the adjustments to operating income referred to in (5) above, decreased for the related income tax impact of \$47.9 million and increased for a measurement-period adjustment related to the Tax Cuts and Jobs Act of \$0.9 million and rabbi trust expense of \$0.1 million.

ASC 605

Year Ended December 31,

	2018			2017		
	GAAP Results	Adjustments	Non-GAAP Results	GAAP Results	Adjustments	Non-GAAP Results
<i>(in thousands, except percentages and per share data)</i>						
Total revenue	\$ 1,216,469	\$ 15,583 (1)	\$ 1,232,052	\$ 1,095,250	\$ 2,856 (4)	\$ 1,098,106
Operating income	399,407	147,583 (2)	546,990	390,728	118,567 (5)	509,295
Operating profit margin	32.8%		44.4%	35.7%		46.4%
Net income	\$ 356,851	\$ 98,832 (3)	\$ 455,683	\$ 259,251	\$ 88,663 (6)	\$ 347,914
Earnings per share – diluted:						
Earnings per share	\$ 4.15		\$ 5.30	\$ 2.98		\$ 4.01
Weighted average shares	85,913		85,913	86,854		86,854

- (1) Amount represents the revenue not reported during the period as a result of the acquisition accounting adjustment associated with the accounting for deferred revenue in business combinations.
- (2) Amount represents \$83.3 million of stock-based compensation expense, \$4.3 million of excess payroll taxes related to stock-based awards, \$40.8 million of amortization expense associated with intangible assets acquired in business combinations, \$3.5 million of transaction expenses related to business combinations and the \$15.6 million adjustment to revenue as reflected in (1) above.
- (3) Amount represents the impact of the adjustments to operating income referred to in (2) above, decreased for the related income tax impact of \$49.7 million and increased for a measurement-period adjustment related to the Tax Cuts and Jobs Act of \$0.9 million and rabbi trust expense of \$0.1 million.
- (4) Amount represents the revenue not reported during the period as a result of the acquisition accounting adjustment associated with the accounting for deferred revenue in business combinations.
- (5) Amount represents \$53.2 million of stock-based compensation expense, \$49.8 million of amortization expense associated with intangible assets acquired in business combinations, \$11.7 million of restructuring charges, \$1.1 million of transaction expenses related to business combinations and the \$2.9 million adjustment to revenue as reflected in (4) above.
- (6) Amount represents the impact of the adjustments to operating income referred to in (5) above, decreased for the related income tax impact of \$52.5 million, excluding the impact of the Tax Cuts and Jobs Act, and rabbi trust income of \$0.1 million, and increased for total net impacts of the Tax Cuts and Jobs Act of \$22.7 million.

Non-GAAP Measures

We use non-GAAP financial measures (a) to evaluate our historical and prospective financial performance as well as our performance relative to our competitors, (b) to set internal sales targets and spending budgets, (c) to allocate resources, (d) to measure operational profitability and the accuracy of forecasting, (e) to assess financial discipline over operational expenditures and (f) as an important factor in determining variable compensation for management and employees. In addition, many financial analysts that follow us focus on and publish both historical results and future projections based on non-GAAP financial measures. We believe that it is in the best interest of our investors to provide this information to analysts so that they accurately report the non-GAAP financial information. Moreover, investors have historically requested, and we have historically reported, these non-GAAP financial measures as a means of providing consistent and comparable information with past reports of financial results.

While we believe that these non-GAAP financial measures provide useful supplemental information to investors, there are limitations associated with the use of these non-GAAP financial measures. These non-GAAP financial measures are not prepared in accordance with GAAP, are not reported by all our competitors and may not be directly comparable to similarly titled measures of our competitors due to potential differences in the exact method of calculation. We compensate for these limitations by using these non-GAAP financial measures as supplements to GAAP financial measures and by reviewing the reconciliations of the non-GAAP financial measures to their most comparable GAAP financial measures.

The adjustments to these non-GAAP financial measures, and the basis for such adjustments, are outlined below:

Acquisition accounting for deferred revenue and its related tax impact. Historically, we have consummated acquisitions in order to support our strategic and other business objectives. In accordance with the fair value provisions applicable to the accounting for business combinations, acquired deferred revenue is often recorded on the opening balance sheet at an amount that is lower than the historical carrying value. Although this acquisition accounting requirement has no impact on our business or cash flow, it adversely impacts our reported GAAP revenue in the reporting periods following an acquisition. In order to provide investors with financial information that facilitates comparison of both historical and future results, we provide non-GAAP financial measures which exclude the impact of the acquisition accounting adjustment. We believe that this non-GAAP financial adjustment is useful to investors because it allows investors to (a) evaluate the effectiveness of the methodology and information used by us in our financial and operational decision-making, and (b) compare our past and future reports of financial results as the revenue reduction related to acquired deferred revenue will not recur when related annual lease licenses and software maintenance contracts are renewed in future periods.

Amortization of intangible assets from acquisitions and its related tax impact. We incur amortization of intangible assets, included in our GAAP presentation of amortization expense, related to various acquisitions we have made. We exclude these expenses and their related tax impact for the purpose of calculating non-GAAP operating income, non-GAAP operating profit margin, non-GAAP net income and non-GAAP diluted earnings per share when we evaluate our continuing operational performance because these costs are fixed at the time of an acquisition, are then amortized over a period of several years after the acquisition and generally cannot be changed or influenced by us after the acquisition. Accordingly, we do not consider these expenses for purposes of evaluating our performance during the applicable time period after the acquisition, and we exclude such expenses when making decisions to allocate resources. We believe that these non-GAAP financial measures are useful to investors because they allow investors to (a) evaluate the effectiveness of the methodology and information used by us in our financial and operational decision-making, and (b) compare our past reports of financial results as we have historically reported these non-GAAP financial measures.

Stock-based compensation expense and its related tax impact. We incur expense related to stock-based compensation included in our GAAP presentation of cost of software licenses; cost of maintenance and service; research and development expense; and selling, general and administrative expense. This non-GAAP adjustment also includes excess payroll tax expense related to stock-based compensation. Stock-based compensation expense (benefit) incurred in connection with our deferred compensation plan held in a rabbi trust includes an offsetting benefit (charge) recorded in other income (expense). Although stock-based compensation is an expense and viewed as a form of compensation, we exclude these expenses for the purpose of calculating non-GAAP operating income, non-GAAP operating profit margin, non-GAAP net income and non-GAAP diluted earnings per share when we evaluate our continuing operational performance. We similarly exclude income (expense) related to assets held in a rabbi trust in connection with our deferred compensation plan. Specifically, we exclude stock-based compensation and income (expense) related to assets held in the deferred compensation plan rabbi trust during our annual budgeting process and our quarterly and annual assessments of our performance. The annual budgeting process is the primary mechanism whereby we allocate resources to various initiatives and operational requirements. Additionally, the annual review by our board of directors during which it compares our historical business model and profitability to the planned business model and profitability for the forthcoming year excludes the impact of stock-based compensation. In evaluating the performance of our senior management and department managers, charges related to stock-based compensation are excluded from expenditure and profitability results. In fact, we record stock-based compensation expense into a stand-alone cost center for which no single operational manager is responsible or accountable. In this way, we can review, on a period-to-period basis, each manager's performance and assess financial discipline over operational expenditures without the effect of stock-based compensation. We believe that these non-GAAP financial measures are useful to investors because they allow investors to (a) evaluate our operating results and the effectiveness of the methodology used by us to review our operating results, and (b) review historical comparability in our financial reporting as well as comparability with competitors' operating results.

Restructuring charges and the related tax impact. We occasionally incur expenses for restructuring our workforce included in our GAAP presentation of cost of software licenses; cost of maintenance and service; research and development expense; and selling, general and administrative expense. We exclude these expenses for the purpose of calculating non-GAAP operating income, non-GAAP operating profit margin, non-GAAP net income and non-GAAP diluted earnings per share when we evaluate our continuing operational performance, as we generally do not incur these expenses as a part of our operations. We believe that these non-GAAP financial measures are useful to investors because they allow investors to (a) evaluate our operating results and the effectiveness of the methodology used by us to review our operating results, and (b) review historical comparability in our financial reporting as well as comparability with competitors' operating results.

Transaction costs related to business combinations. We incur expenses for professional services rendered in connection with business combinations, which are included in our GAAP presentation of selling, general and administrative expense. These expenses are generally not tax-deductible. We exclude these acquisition-related transaction expenses, derived from announced

acquisitions, for the purpose of calculating non-GAAP operating income, non-GAAP operating profit margin, non-GAAP net income and non-GAAP diluted earnings per share when we evaluate our continuing operational performance, as we generally would not have otherwise incurred these expenses in the periods presented as a part of our operations. We believe that these non-GAAP financial measures are useful to investors because they allow investors to (a) evaluate our operating results and the effectiveness of the methodology used by us to review our operating results, and (b) review historical comparability in our financial reporting as well as comparability with competitors' operating results.

Tax Cuts and Jobs Act. We recorded impacts to our income tax provision related to the enactment of the Tax Cuts and Jobs Act, specifically for the transition tax related to unrepatriated cash and the impacts of the tax rate change on net deferred tax assets. We exclude these impacts for the purpose of calculating non-GAAP net income and non-GAAP diluted earnings per share when we evaluate our continuing operational performance, as (i) the charges are not expected to recur as part of our normal operations and (ii) the charges resulted from the extremely infrequent event of major U.S. tax reform, the last such reform having occurred in 1986. We believe that these non-GAAP financial measures are useful to investors because they allow investors to (a) evaluate our operating results and the effectiveness of the methodology used by us to review our operating results, and (b) review historical comparability in our financial reporting.

Non-GAAP financial measures are not in accordance with, or an alternative for, GAAP. Our non-GAAP financial measures are not meant to be considered in isolation or as a substitute for comparable GAAP financial measures and should be read only in conjunction with our consolidated financial statements prepared in accordance with GAAP.

We have provided a reconciliation of the non-GAAP financial measures to the most directly comparable GAAP financial measures as listed below:

GAAP Reporting Measure

- Revenue
- Operating Income
- Operating Profit Margin
- Net Income
- Diluted Earnings Per Share

Non-GAAP Reporting Measure

- Non-GAAP Revenue
- Non-GAAP Operating Income
- Non-GAAP Operating Profit Margin
- Non-GAAP Net Income
- Non-GAAP Diluted Earnings Per Share

Liquidity and Capital Resources

<i>(in thousands, except percentages)</i>	As of December 31,		Change	
	2019	2018	Amount	%
Cash, cash equivalents and short-term investments	\$ 872,382	\$ 777,364	\$ 95,018	12.2
Working capital	\$ 860,340	\$ 786,410	\$ 73,930	9.4

Cash, Cash Equivalents and Short-Term Investments

Cash and cash equivalents consist primarily of highly liquid investments such as money market funds and deposits held at major banks. Short-term investments consist primarily of deposits held by certain of our foreign subsidiaries with original maturities of three months to one year. The following table presents our foreign and domestic holdings of cash, cash equivalents and short-term investments:

<i>(in thousands, except percentages)</i>	As of December 31,			
	2019	% of Total	2018	% of Total
Domestic	\$ 626,433	71.8	\$ 616,249	79.3
Foreign	245,949	28.2	161,115	20.7
Total	\$ 872,382		\$ 777,364	

In general, it is our intention to permanently reinvest all earnings in excess of previously taxed amounts. As part of Tax Reform, substantially all of the previous earnings of our non-U.S. subsidiaries were taxed through the transition tax and current earnings are taxed as part of GILTI tax expense. These taxes increased our previously taxed earnings and allow for the repatriation of the majority of our foreign earnings without any residual U.S. federal tax. While we believe that the financial reporting bases may be greater than the tax bases of investments in foreign subsidiaries for any earnings in excess of previously taxed amounts, such amounts are considered permanently reinvested. The cumulative temporary difference related to such permanently reinvested earnings is approximately \$32.8 million and we would anticipate the tax effect on those earnings to be immaterial as a result of Tax Reform.

The amount of cash, cash equivalents and short-term investments held by foreign subsidiaries is subject to translation adjustments caused by changes in foreign currency exchange rates as of the end of each respective reporting period, the offset to which is recorded in accumulated other comprehensive loss on our consolidated balance sheet.

Cash Flows from Operating Activities

<i>(in thousands)</i>	Year Ended December 31,			Change	
	2019	2018	2017	2019 vs. 2018	2018 vs. 2017
Net cash provided by operating activities	\$ 499,936	\$ 484,988	\$ 427,660	\$ 14,948	\$ 57,328

Fiscal year 2019 as compared to fiscal year 2018

Net cash provided by operating activities increased during the current fiscal year due to increased net income (net of non-cash operating adjustments) of \$107.4 million, partially offset by decreased net cash flows from operating assets and liabilities of \$92.4 million.

Fiscal year 2018 as compared to fiscal year 2017

Net cash provided by operating activities increased during the prior fiscal year due to increased net income (net of non-cash operating adjustments) of \$151.4 million, partially offset by decreased net cash flows from operating assets and liabilities of \$94.1 million.

Cash Flows from Investing Activities

<i>(in thousands)</i>	Year Ended December 31,			Change	
	2019	2018	2017	2019 vs. 2018	2018 vs. 2017
Net cash used in investing activities	\$ (833,548)	\$ (312,231)	\$ (94,665)	\$ (521,317)	\$ (217,566)

Fiscal year 2019 as compared to fiscal year 2018

Net cash used in investing activities increased during the current fiscal year due primarily to increased acquisition-related net cash outlays of \$504.2 million and increased capital expenditures of \$23.2 million. We currently plan capital spending of \$45.0 million to \$55.0 million during fiscal year 2020 as compared to the \$44.9 million that was spent in fiscal year 2019. The level of spending will depend on various factors, including the growth of the business and general economic conditions.

Fiscal year 2018 as compared to fiscal year 2017

Net cash used in investing activities increased during the prior fiscal year due primarily to increased acquisition-related net cash outlays of \$219.1 million.

Cash Flows from Financing Activities

<i>(in thousands)</i>	Year Ended December 31,			Change	
	2019	2018	2017	2019 vs. 2018	2018 vs. 2017
Net cash provided by (used in) financing activities	\$ 429,409	\$ (262,675)	\$ (294,651)	\$ 692,084	\$ 31,976

Fiscal year 2019 as compared to fiscal year 2018

Net cash provided by financing activities increased during the current fiscal year due primarily to \$500.0 million in proceeds from long-term debt obtained in fiscal year 2019 related to the LST acquisition and decreased stock repurchases of \$210.7 million, partially offset by increased restricted stock unit withholding taxes paid in lieu of issuing shares of \$13.6 million.

Fiscal year 2018 as compared to fiscal year 2017

Net cash used in financing activities decreased during the prior fiscal year due primarily to decreased stock repurchases of \$66.2 million, partially offset by increased restricted stock unit withholding taxes paid in lieu of issuing shares of \$17.8 million and decreased proceeds from shares issued for stock-based compensation of \$11.5 million.

Other Cash Flow Information

We believe that existing cash and cash equivalent balances of \$872.1 million, together with cash generated from operations and access to the \$500.0 million revolving credit facility, will be sufficient to meet our working capital and capital expenditure requirements through the next twelve months. Our cash requirements in the future may also be financed through additional equity or debt financings. There can be no assurance that such financings can be obtained on favorable terms, if at all. We repaid \$75.0 million of our unsecured term loan in January 2020 prior to its scheduled maturity date.

Under our stock repurchase program, we repurchased shares as follows:

<i>(in thousands, except per share data)</i>	Year Ended December 31,		
	2019	2018	2017
Number of shares repurchased	330	1,674	2,750
Average price paid per share	\$ 179.41	\$ 161.12	\$ 122.20
Total cost	\$ 59,116	\$ 269,801	\$ 336,042

In February 2018, our Board of Directors increased the number of shares authorized for repurchase to a total of 5.0 million shares under the stock repurchase program. As of December 31, 2019, 3.5 million shares remained available for repurchase under the program.

The authorized repurchase program does not have an expiration date, and the pace of the repurchase activity will depend on factors such as working capital needs, cash requirements for acquisitions, our stock price, and economic and market conditions. Our stock repurchases may be effected from time to time through open market purchases or pursuant to a Rule 10b5-1 plan.

We continue to generate positive cash flows from operating activities and believe that the best uses of our excess cash are to invest in the business; acquire or make investments in complementary companies, products, services and technologies; and make payments on our outstanding debt balances. Any future acquisitions may be funded by available cash and investments, cash generated from operations, debt financing, or the issuance of additional securities. Additionally, we have in the past, and expect in the future, to repurchase stock in order to both offset dilution and return capital, in excess of our requirements, to stockholders with the goal of increasing stockholder value.

Off-Balance-Sheet Arrangements

We do not have any special-purpose entities or off-balance-sheet arrangements.

Contractual Obligations

Our significant contractual obligations as of December 31, 2019 are summarized below:

<i>(in thousands)</i>	Payments Due by Period				
	Total	Within 1 year	2 – 3 years	4 – 5 years	After 5 years
Long-term debt:					
Principal payments ⁽¹⁾	\$ 500,000	\$ —	\$ 25,000	\$ 475,000	\$ —
Interest payments ⁽²⁾	70,488	17,372	29,400	23,716	—
Global headquarters operating lease ⁽³⁾	45,199	4,464	8,928	8,944	22,863
Other operating leases ⁽⁴⁾	83,566	17,153	27,127	15,990	23,296
Unconditional purchase obligations ⁽⁵⁾	71,382	37,183	24,723	9,476	—
Obligations related to uncertain tax positions, including interest and penalties ⁽⁶⁾	—	—	—	—	—
Other long-term obligations ⁽⁷⁾	44,767	22,776	10,568	2,856	8,567
Total contractual obligations	\$ 815,402	\$ 98,948	\$ 125,746	\$ 535,982	\$ 54,726

- (1) We repaid \$75.0 million of the unsecured term loan in January 2020 prior to its scheduled maturity date. As such, the payment is reflected as current on our consolidated balance sheet but not in the table above.
- (2) Interest on the long-term debt is estimated using the interest rate as of December 31, 2019, as the interest rate is variable. For additional information, see Note 10 to the consolidated financial statements included in Part IV, Item 15 of this Annual Report on Form 10-K. The interest payments reflected in the table above have not been reduced for the effect of the \$75.0 million principal payment discussed in (1) above.
- (3) We previously entered into a lease agreement for 186,000 square feet of rentable space located in an office facility in Canonsburg, Pennsylvania, which serves as our headquarters. The term of the lease is 183 months, beginning on October 1, 2014 and expiring on December 31, 2029. We have a one-time right to terminate the lease on December 31, 2025 by providing the landlord with at least 18 months' prior written notice of such termination.
- (4) Other operating leases primarily include noncancellable lease commitments for our other domestic and international offices as well as certain operating equipment.
- (5) Unconditional purchase obligations primarily include royalties and software licenses and services, which are unrecorded as of December 31, 2019.
- (6) We have \$64.4 million of unrecognized tax benefits, including estimated interest and penalties, that have been recorded as liabilities in accordance with income tax accounting guidance for which we are uncertain as to if or when such amounts may be settled. As a result, such amounts are excluded from the table above.
- (7) Other long-term obligations primarily include third-party commissions of \$28.3 million; post-employment benefits, including pension obligations, of \$12.7 million for certain foreign locations; and office space restoration of \$3.1 million. These amounts include the related current portions when applicable.

Critical Accounting Policies and Estimates

We believe that the following critical accounting policies affect the more significant judgments and estimates used in the preparation of our consolidated financial statements.

Revenue Recognition: Our revenue is derived principally from the licensing of computer software products and from related maintenance contracts. We adopted ASC 606 on January 1, 2018 using the modified retrospective approach for all contracts not completed as of the date of adoption. Results for reporting periods beginning after January 1, 2018 are presented under ASC 606, while prior period amounts are not adjusted and continue to be reported in accordance with ASC 605. The adoption of ASC 606 represents a change in accounting principle that will more closely align revenue recognition with the delivery of our software licenses, maintenance and services.

Revenue Recognition Policy 2019 and 2018 (ASC 606)

We enter into contracts that include combinations of products, maintenance and services, which are accounted for as separate performance obligations with differing revenue recognition patterns.

Revenue from perpetual licenses is classified as software license revenue. Software license revenue is recognized up front upon delivery of the licensed product and/or the utility that enables the customer to access authorization keys, provided that an enforceable contract has been received. Typically, our perpetual licenses are sold with post-contract support (PCS), which includes unspecified technical enhancements and customer support. We allocate value in bundled perpetual and PCS arrangements based on the standalone selling prices of the perpetual license and PCS. Revenue from PCS is classified as maintenance revenue and is recognized ratably over the term of the contract, as we satisfy the PCS performance obligation over time.

In addition to perpetual licenses, we sell time-based lease licenses. Lease licenses are sold only as a bundled arrangement that includes the rights to a term software license and PCS. Utilizing observable inputs, we determined that 50% of the estimated standalone selling price of the lease license is attributable to the term license and 50% is attributable to the PCS. This determination considered the value relationship for our products between PCS to time-based lease licenses, the value relationship between PCS and perpetual licenses, the average economic life of our products, software renewal rates and the price of the bundled arrangement in relation to the perpetual licensing approach. Consistent with the perpetual sales, the license component is classified as software license revenue and recognized as revenue up front at the commencement of the lease upon delivery of the licensed product and/or utility that enables the customer to access authorization keys. The PCS is classified as maintenance revenue and is recognized ratably over the term of the contract, as we provide the PCS benefit over time.

Revenue from training, support and other services is recognized as the services are performed. For contracts in which the service consists of a single performance obligation, such as providing a training class to a customer, we recognize revenue upon completion of the performance obligation. For service contracts that are longer in duration and often include multiple performance obligations (for example, both training and consulting), we measure the progress toward completion of the obligations and recognize revenue accordingly. In measuring progress towards the completion of performance obligations, we typically utilize output-based estimates for services with contractual billing arrangements that are not based on time and materials, and estimate output based on the total tasks completed as compared to the total tasks required for each work contract. Input-based estimates are utilized for services that involve general consultations with contractual billing arrangements based on time and materials, utilizing direct labor as the input measure. Proceeds from customers for the purpose of expediting road-map items, developing new products or creating specific features and functionality for existing products is classified as revenue.

We also execute arrangements through independent channel partners in which the channel partners are authorized to market and distribute our software products to end users of our products and services in specified territories. In sales facilitated by channel partners, the channel partner bears the risk of collection from the end-user customer. We recognize revenue from transactions with channel partners in a manner consistent with the direct sales described above for both perpetual and time-based licenses. Revenue from channel partner transactions is the amount remitted to us by the channel partners. This amount includes a fee for PCS that is compensation for providing technical enhancements and the second level of technical support to the end user, which is recognized over the period that PCS is to be provided.

Non-income related taxes collected from customers and remitted to governmental authorities are recorded on the consolidated balance sheet as accounts receivable and accrued expenses. The collection and payment of these amounts are reported on a net basis in the consolidated statements of income and do not impact reported revenues or expenses.

We do not offer right of return. We warrant to our customers that our software will perform substantially as specified in our current user manuals. We have not experienced significant claims related to software warranties beyond the scope of

maintenance support, which we are already obligated to provide. The warranty is not sold, and cannot be purchased, separately. The warranty does not provide any type of additional service to the customer or performance obligation for us.

Our agreements with our customers generally require us to indemnify the customer against claims that our software infringes third-party patent, copyright, trademark or other proprietary rights. Such indemnification obligations are generally limited in a variety of industry-standard respects, including our right to replace an infringing product.

Significant Judgments (ASC 606)

Our contracts with customers typically include promises to transfer licenses and services to a customer. Judgment is required to determine if the promises are separate performance obligations, and if so, to allocate the transaction price to each performance obligation. We use the estimated standalone selling price method to allocate the transaction price for each performance obligation. The estimated standalone selling price is determined using all information reasonably available to us, including market conditions and other observable inputs. The corresponding revenues are recognized as the related performance obligations are satisfied.

We apply a practical expedient to expense sales commissions as incurred when the amortization period would have been one year or less. Sales commissions associated with the initial year of multi-year contracts are expensed as incurred due to their immateriality. Sales commissions associated with multi-year contracts beyond the initial year are subject to an employee service requirement and are expensed as incurred as they are not considered incremental costs to obtain a contract.

We are required to adjust promised amounts of consideration for the effects of the time value of money if the timing of the payments provides the customer or us with a significant financing benefit. We consider various factors in assessing whether a financing component exists, including the duration of the contract, market interest rates and the timing of payments. Our contracts do not include a significant financing component requiring adjustment to the transaction price.

Revenue Recognition Policy 2017 (ASC 605)

Revenue from perpetual licenses was classified as license revenue and was recognized upon delivery of the licensed product and/or the utility that enabled the customer to access authorization keys, provided that acceptance had occurred and a signed contractual obligation was received, the price was fixed and determinable, and collectibility of the receivable was probable. We determined the fair value of PCS sold together with perpetual licenses based on the rate charged for PCS when sold separately. Revenue from PCS contracts was classified as maintenance and service revenue and was recognized ratably over the term of the contract.

Revenue for software lease licenses was classified as license revenue and was recognized over the period of the lease contract. Typically, our software leases include PCS which, due to the short term (principally one year or less) of our software lease licenses, were not permitted to be separated from lease revenue for accounting purposes. As a result, both the lease licenses and PCS were recognized ratably over the lease period. We included the revenue for the entire lease arrangement within software license revenue in the consolidated statements of income.

Many of our semiconductor products are typically licensed via longer term leases of 24–36 months. We recognized revenue for these licenses over the term of the lease contract. Because we did not have vendor-specific objective evidence of the fair value of these leases, we also recognized revenue from perpetual licenses over the term of the lease contract during the infrequent occurrence of these licenses being sold with semiconductor leases in multiple-element arrangements.

Revenue from training, support and other services was recognized as the services were performed. We applied the specific performance method to contracts in which the service consisted of a single act, such as providing a training class to a customer, and the proportional performance method to other service contracts that were longer in duration and often included multiple acts (for example, both training and consulting). In applying the proportional performance method, we typically utilized output-based estimates for services with contractual billing arrangements that were not based on time and materials, and estimated output based on the total tasks completed as compared to the total tasks required for each work contract. Input-based estimates were utilized for services that involved general consultations with contractual billing arrangements based on time and materials, utilizing direct labor as the input measure.

The accounting treatment under ASC 605 associated with arrangements through independent channel partners, non-income related taxes, warranties and indemnification obligations is consistent with the accounting treatment under ASC 606 described above.

Goodwill and Other Intangible Assets: We test goodwill and indefinite-lived intangible assets for impairment at least annually by performing a quantitative assessment of whether the fair value of each reporting unit or asset exceeds its carrying amount. We have one reporting unit. Goodwill is tested at this reporting unit level and indefinite-lived intangible assets are tested at the individual asset level. This requires us to assess and make judgments regarding a variety of factors which impact the fair value

of the reporting unit or asset being tested, including business plans, anticipated future cash flows, economic projections and other market data. Because there are inherent uncertainties involved in these factors, significant differences between these estimates and actual results could result in future impairment charges and could materially impact our future financial results. During the first quarter of 2019, we completed the annual impairment test for goodwill and the indefinite-lived intangible asset and determined that these assets had not been impaired as of the test date, January 1, 2019. No other events or circumstances changed during the year ended December 31, 2019 that would indicate that the fair values of our reporting unit and indefinite-lived intangible asset are below their carrying values.

Intangible assets are recognized apart from goodwill whenever an acquired intangible asset arises from contractual or other legal rights, or whenever it is capable of being separated or divided from the acquired entity and sold, transferred, licensed, rented, or exchanged, either individually or in combination with a related contract, asset or liability. We determined the fair value of our intangible assets using various valuation techniques, including the relief-from-royalty method and the multi-period excess earnings method. These models utilize certain unobservable inputs classified as Level 3 measurements as defined by ASC 820, *Fair Value Measurements and Disclosures*. The determination of fair value requires considerable judgment and is sensitive to changes in underlying assumptions, estimates and market factors. Estimating fair value requires us to make assumptions and estimates regarding our future plans, as well as industry and economic conditions. These assumptions and estimates include, but are not limited to: royalty rate, discount rate and attrition rate. The fair values of the intangible assets will be amortized over their useful lives. Impairment losses are recognized if the carrying amounts of finite-lived intangible assets are both not recoverable and exceed the fair values.

Income Taxes: We account for income taxes under the asset and liability method, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of events that have been included in the financial statements. Under this method, deferred tax assets and liabilities are determined based on the differences between the financial statement and tax bases of assets and liabilities using enacted tax rates in effect for the year in which the differences are expected to reverse. The effect of a change in tax rates on deferred tax assets and liabilities is recognized in income in the period of the enactment date.

We record net deferred tax assets to the extent we believe these assets will more likely than not be realized. In making such determination, we consider all available positive and negative evidence, including scheduled reversals of deferred tax liabilities, projected future taxable income, tax planning strategies and recent financial operations. In the event we determine that we will be able to realize deferred tax assets for which a valuation allowance was used to reduce their carrying value, the adjustment to the valuation allowance will be recorded as a reduction to the provision for income taxes.

Tax benefits related to uncertain tax positions taken or expected to be taken on a tax return are recorded when such benefits meet a more-likely-than-not threshold. Otherwise, these tax benefits are recorded when a tax position has been effectively settled, which means that the statute of limitations has expired or the appropriate taxing authority has completed its examination even though the statute of limitations remains open.

We recognize interest and penalties related to income taxes within the income tax expense line in the consolidated statements of income. Accrued interest and penalties are included within the related tax liability line in the consolidated balance sheets.

Stock-Based Compensation: We grant restricted stock units and other stock awards to employees and directors under our equity incentive plan. Eligible employees can also purchase shares of our common stock at a discount under our employee stock purchase plan. The benefits provided under these plans are stock-based payments subject to the provisions of stock-based payment accounting guidance. We use the fair value method to apply the provisions of stock-based payment accounting guidance. Stock-based compensation expense for 2019, 2018 and 2017 was \$116.2 million, \$83.3 million and \$53.2 million, respectively. As of December 31, 2019, total unrecognized estimated compensation expense related to awards granted prior to that date was \$186.4 million, which is expected to be recognized over a weighted average period of 1.5 years.

Prior to 2017, we granted stock option awards. The value of each stock option award was estimated on the date of grant, or date of acquisition for options issued in a business combination, using the Black-Scholes option pricing model (Black-Scholes model). The determination of the fair value of stock-based payment awards using an option pricing model was affected by our stock price as well as assumptions regarding a number of complex and subjective variables. These variables included our stock volatility during the preceding six years, actual and projected employee stock option exercise behaviors, interest rate assumptions using the five-year U.S. Treasury Note yield on the date of grant or acquisition date, and expected dividends. The stock-based compensation expense for options is recorded ratably over the requisite service period.

We issue various restricted stock unit awards which contain either a market condition, a performance condition, a service condition, or certain combinations of the three. Restricted stock unit awards are valued based on the grant-date fair value of the award. Stock-based compensation expense is recognized over the employee's requisite service period for awards with only a service condition. For awards with a performance condition, stock-based compensation expense is recorded from the service

inception date through the conclusion of the measurement period based on management's estimates concerning the probability of vesting.

Vesting of restricted stock unit awards with a market condition is based on our performance as measured by total stockholder return relative to the appreciation of a specified stock index over the measurement period, subject to each participant's continued employment through the conclusion of the measurement period. The fair value of the restricted stock unit awards with a market condition is estimated using a Monte Carlo simulation model. The determination of the fair value of the awards is affected by the grant date and several variables, each of which has been identified in the chart below. Stock-based compensation expense based on the fair value of the award is recorded from the grant date through the conclusion of the measurement period.

Assumptions used in Monte Carlo lattice pricing model	Year Ended December 31,		
	2019	2018	2017
Risk-free interest rate	2.5%	2.4%	1.5%
Expected dividend yield	—%	—%	—%
Expected volatility—Ansys stock price	23%	21%	19%
Expected volatility—Nasdaq Composite Index	16%	15%	15%
Expected term	2.8 years	2.8 years	2.8 years
Correlation factor	0.71	0.65	0.70
Weighted average fair value per share	\$238.99	\$191.76	\$120.94

We also grant restricted stock units to non-employee Directors, which vest upon the earlier of one year from the date of grant or the date of the next regular annual meeting of stockholders. If a non-employee Director retires prior to the vest date, the non-employee Director receives a pro-rata portion of the restricted stock units.

To the extent we change the terms of our stock-based compensation programs, experience market volatility in the pricing of our common stock that increases the implied volatility assumption used in the pricing models, refine different assumptions, or assume stock awards from acquired companies that are different in nature than our stock award arrangements, among other potential impacts, the stock-based compensation expense recorded in future periods and the related tax benefits may differ significantly from what was recorded in previous reporting periods. Forfeitures of awards are accounted for as they occur.

Estimates of stock-based compensation expense are significant to our financial statements, but this expense is partially based on the aforementioned option valuation and Monte Carlo simulation models and will never result in the payment of cash by us other than through the payment of withholding taxes in lieu of additional share issuance. For this reason, and because we do not view stock-based compensation as related to our operational performance, the Board of Directors and management exclude stock-based compensation expense when evaluating our underlying business performance.

Contingencies: We are involved in various investigations, claims and legal proceedings that arise in the ordinary course of business, including commercial disputes, labor and employment matters, tax audits, alleged infringement of intellectual property rights and other matters. We review the status of these matters, assess our financial exposure and record a related accrual if the potential loss from an investigation, claim or legal proceeding is probable and the amount is reasonably estimable. Significant judgment is involved in the determination of probability and in the determination of whether an exposure is reasonably estimable. As a result of the uncertainties involved in making these estimates, we may have to revise our estimates as facts and circumstances change. The revision of these estimates could have a material impact on our financial position and results of operations.

Recent Accounting Guidance

For information regarding recent accounting guidance and its impact on our consolidated financial statements, see Note 2 to the consolidated financial statements in Part IV, Item 15 of this Annual Report on Form 10-K.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Interest Rate Risk. Changes in the overall level of interest rates affect the interest income that is generated from our cash, cash equivalents and short-term investments and the interest expense that is generated from our outstanding borrowings. For the year ended December 31, 2019, interest income was \$12.8 million and interest expense was \$3.5 million. Cash and cash equivalents consist primarily of highly liquid investments such as money market funds and deposits held at major banks. Short-term investments consist primarily of deposits held by certain foreign subsidiaries with original maturities of three months to one year.

Foreign Currency Transaction Risk. As we operate in international regions, a portion of our revenue, expenses, cash, accounts receivable and payment obligations are denominated in foreign currencies. As a result, changes in currency exchange rates will affect our financial position, results of operations and cash flows. We are most impacted by movements in and among the British Pound, Euro, Japanese Yen, South Korean Won and U.S. Dollar.

With respect to revenue, on average for the year ended December 31, 2019, the U.S. Dollar was approximately 3.3% stronger, when measured against our primary foreign currencies, than for the year ended December 31, 2018. The table below presents the impacts of currency fluctuations on revenue for the year ended December 31, 2019. Amounts in brackets indicate a net adverse impact from currency fluctuations.

<i>(in thousands)</i>	Year Ended December 31, 2019
Euro	\$ (17,361)
South Korean Won	(5,097)
British Pound	(1,881)
Japanese Yen	1,791
Other	(1,460)
Total	<u>\$ (24,008)</u>

The net overall stronger U.S. Dollar also resulted in decreased operating income of \$10.2 million for the year ended December 31, 2019 as compared to the year ended December 31, 2018.

The most significant currency impacts on revenue and operating income are typically attributable to U.S. Dollar exchange rate changes against the British Pound, Euro, Japanese Yen and South Korean Won. Historical exchange rates for these currency pairs are reflected in the charts below:

As of	Period End Exchange Rates			
	GBP/USD	EUR/USD	USD/JPY	USD/KRW
December 31, 2016	1.234	1.051	116.918	1,208.313
December 31, 2017	1.351	1.200	112.701	1,068.376
December 31, 2018	1.276	1.147	109.589	1,115.325
December 31, 2019	1.326	1.121	108.637	1,156.069

Year Ended	Average Exchange Rates			
	GBP/USD	EUR/USD	USD/JPY	USD/KRW
December 31, 2017	1.289	1.130	112.139	1,130.945
December 31, 2018	1.335	1.181	110.405	1,100.786
December 31, 2019	1.277	1.119	109.033	1,165.479

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

The following tables set forth selected unaudited quarterly information. We believe that the amounts stated below present fairly the results of such periods when read in conjunction with the consolidated financial statements and related notes included in Part IV, Item 15 of this Annual Report on Form 10-K.

Other information required by this Item is included in Part IV, Item 15 of this Annual Report on Form 10-K.

<i>(in thousands, except per share data)</i>	Fiscal Quarter Ended			
	December 31, 2019	September 30, 2019	June 30, 2019	March 31, 2019
Revenue	\$ 486,228	\$ 343,899	\$ 368,635	\$ 317,130
Gross profit	436,632	302,534	328,138	282,315
Operating income	185,716	105,047	128,628	95,649
Net income	165,852	89,463	109,750	86,230
Earnings per share – basic	\$ 1.95	\$ 1.06	\$ 1.31	\$ 1.03
Earnings per share – diluted	\$ 1.91	\$ 1.04	\$ 1.28	\$ 1.01

<i>(in thousands, except per share data)</i>	Fiscal Quarter Ended			
	December 31, 2018	September 30, 2018	June 30, 2018	March 31, 2018
Revenue	\$ 415,432	\$ 289,418	\$ 305,913	\$ 282,873
Gross profit	375,343	253,110	265,463	243,835
Operating income	179,936	93,024	108,553	95,061
Net income	153,163	89,336	92,596	84,280
Earnings per share – basic	\$ 1.83	\$ 1.06	\$ 1.10	\$ 1.00
Earnings per share – diluted	\$ 1.79	\$ 1.04	\$ 1.08	\$ 0.98

ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

None.

ITEM 9A. CONTROLS AND PROCEDURES

Evaluation of Disclosure Controls and Procedures. As required by Rules 13a-15 and 15d-15 of the Securities Exchange Act of 1934, as amended, or the Exchange Act, we have evaluated, with the participation of management, including the Chief Executive Officer and the Chief Financial Officer, the effectiveness of the design and operation of our disclosure controls and procedures as of the end of the period covered by this report. Based on such evaluation, the Chief Executive Officer and Chief Financial Officer have concluded that such disclosure controls and procedures are effective, as defined in Rule 13a-15(e) of the Exchange Act.

We believe, based on our knowledge, that the financial statements and other financial information included in this report fairly present, in all material respects, our financial condition, results of operations and cash flows as of and for the periods presented in this report. We are committed to both a sound internal control environment and to good corporate governance.

From time to time, we review the disclosure controls and procedures, and may periodically make changes to enhance their effectiveness and to ensure that our systems evolve with our business.

Management's Report on Internal Control over Financial Reporting. Management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in Exchange Act Rules 13a-15(f). Under the supervision and with the participation of management, including our Chief Executive Officer and Chief Financial Officer, we have conducted an evaluation of the effectiveness of our internal control over financial reporting based upon the *Internal Control – Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission. Based on this evaluation, our Chief Executive Officer and Chief Financial Officer have concluded that our internal control over financial reporting was effective at December 31, 2019.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with policies or procedures may deteriorate.

Additionally, Deloitte & Touche LLP, an independent registered public accounting firm, has audited the financial statements included in this Annual Report on Form 10-K and has issued an attestation report on our internal control over financial reporting. This report is included in Item 15 of this Annual Report on Form 10-K.

Changes in Internal Controls. There were no changes in our internal control over financial reporting that occurred during the three months ended December 31, 2019 that materially affected, or were reasonably likely to materially affect, our internal control over financial reporting.

ITEM 9B. OTHER INFORMATION

None.

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The information required by this Item is incorporated by reference to our 2020 Proxy Statement and is set forth under “Corporate Governance at Ansys,” “Director Nominations,” “Continuing Directors Following the 2020 Annual Meeting,” “Our Executive Officers,” “Delinquent Section 16(a) Reports” and “Audit Committee” therein.

We adopted a Code of Business Conduct and Ethics that applies to our principal executive officer, principal financial and accounting officer, and all of our directors and employees. Our Code of Business Conduct and Ethics is posted under the Corporate Responsibility tab of the Investor Relations section of our website at <https://investors.ansys.com>. We will post any amendments to, or waiver of, our Code of Business Conduct and Ethics that apply to our principal executive officer and principal financial and accounting officer on our website.

ITEM 11. EXECUTIVE COMPENSATION

The information required by this Item is incorporated by reference to our 2020 Proxy Statement and is set forth under “Compensation Discussion and Analysis,” “Compensation Policies and Practices Related to Risk Management,” “Fiscal 2019 Compensation Tables,” “2019 CEO Pay Ratio,” “Compensation Committee Report,” “Compensation Committee Interlocks and Insider Participation,” “Director Nominations” and “Non-Employee Director Compensation” therein.

ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT, AND RELATED STOCKHOLDER MATTERS

Equity Compensation Plan Information as of December 31, 2019

Plan Category	(a)	(b)	(c)
	Number of Securities to be Issued Upon Exercise of Outstanding Options, Warrants and Rights	Weighted Average Exercise Price of Outstanding Options, Warrants and Rights ⁽¹⁾	Number of Securities Remaining Available for Future Issuance Under Equity Compensation Plans (excluding securities reflected in column (a))
Equity Compensation Plans Approved by Security Holders			
1996 Stock Option and Grant Plan	2,617,302 ⁽²⁾	\$ 69.69	4,064,783 ⁽³⁾
1996 Employee Stock Purchase Plan	(4)	(5)	191,960
Equity Compensation Plans Not Approved by Security Holders⁽⁶⁾			
Ansoft Corporation 2006 Stock Incentive Plan	18,650	\$ 48.97	—
Apache Design Solutions, Inc. 2001 Stock/Option Issuance Plan	31,031	\$ 21.27	—
SpaceClaim Corporation 2005 Stock Incentive Plan	1,253	\$ 23.41	—
Gear Design Solutions, Inc. Stock Incentive Plan	3,740	\$ 12.26	—
Total	2,671,976		4,256,743

- (1) The weighted average exercise price does not take into account the shares for outstanding restricted stock units or deferred stock awards, which have no exercise price.
- (2) Includes 1,617,974 shares for outstanding restricted stock units for employees, 929,559 shares for outstanding stock options, 9,688 shares for outstanding restricted stock units for non-employee directors and 60,081 shares for deferred stock awards for non-employee directors. Restricted stock units with a performance or market condition are included based on target performance, unless performance is otherwise known.
- (3) The number of securities remaining available for future issuance assumes maximum attainment for awards with a performance condition or a market condition.
- (4) The number of shares issuable with respect to the current offering period is not determinable until the end of the period.
- (5) The per share purchase price of shares issuable with respect to the current offering period is not determinable until the end of the period.
- (6) We no longer issue awards under equity compensation plans not approved by security holders.

All other information required by this Item is incorporated by reference to our 2020 Proxy Statement and is set forth under “Ownership of Our Common Stock” therein.

ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

The information required by this Item is incorporated by reference to our 2020 Proxy Statement and is set forth under “Director Independence” and “Related-Party Transactions” therein.

ITEM 14. PRINCIPAL ACCOUNTANT FEES AND SERVICES

The information required by this Item is incorporated by reference to our 2020 Proxy Statement and is set forth under “Independent Registered Accounting Firm Services and Fees” therein.

PART IV

ITEM 15. EXHIBITS AND FINANCIAL STATEMENT SCHEDULES

(a) *Documents Filed as Part of this Annual Report on Form 10-K:*

1. *Financial Statements:* The following consolidated financial statements and reports are filed as part of this report:

- Management's Report on Internal Control over Financial Reporting	61
- Reports of Independent Registered Public Accounting Firm	62
- Consolidated Balance Sheets as of December 31, 2019 and 2018	66
- Consolidated Statements of Income for the years ended December 31, 2019, 2018 and 2017	67
- Consolidated Statements of Comprehensive Income for the years ended December 31, 2019, 2018 and 2017	68
- Consolidated Statements of Cash Flows for the years ended December 31, 2019, 2018 and 2017	69
- Consolidated Statements of Stockholders' Equity for the years ended December 31, 2019, 2018 and 2017	70
- Notes to Consolidated Financial Statements	71

2. *Financial Statement Schedule:* The following financial statement schedule is filed as part of this report and should be read in conjunction with the consolidated financial statements.

- Schedule II - Valuation and Qualifying Accounts	98
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Schedules not listed above have been omitted because they are not applicable, are not required or the information required to be set forth therein is included in the consolidated financial statements or notes thereto.

3. *Exhibits:* The exhibits listed in the accompanying Exhibit Index immediately following the financial statement schedule are filed as part of, or incorporated by reference into, this Annual Report on Form 10-K.

(b) *Exhibits:*

We hereby file as part of this Annual Report on Form 10-K the exhibits listed in the Exhibit Index immediately following the financial statement schedule of this Annual Report on Form 10-K.

(c) *Financial Statement Schedule:*

We hereby file as part of this Annual Report on Form 10-K the financial statement schedule listed in Item 15(a)(2) as set forth above.

MANAGEMENT'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

Management is responsible for establishing and maintaining an adequate system of internal control over our financial reporting. In order to evaluate the effectiveness of internal control over financial reporting, management has conducted an assessment, including testing, using the financial reporting criteria in the *Internal Control - Integrated Framework (2013)*, issued by the Committee of Sponsoring Organizations of the Treadway Commission.

Our system of internal control over financial reporting is designed to provide reasonable assurance to management and the Board of Directors regarding the reliability of financial records used in preparation of our published financial statements. As all internal control systems have inherent limitations, even systems determined to be effective can provide only reasonable assurance with respect to financial statement preparation and presentation. Based on their assessment, management has concluded that we maintained an effective system of internal control over financial reporting as of December 31, 2019. Deloitte & Touche LLP, an independent registered public accounting firm, has audited our internal control over financial reporting as of December 31, 2019, as stated in their report which appears in Part IV, Item 15 of this Annual Report on Form 10-K.

/s/ AJEI S. GOPAL

Ajei S. Gopal

President and Chief Executive Officer

February 27, 2020

/s/ MARIA T. SHIELDS

Maria T. Shields

Chief Financial Officer

February 27, 2020

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Stockholders and the Board of Directors of ANSYS, Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of ANSYS, Inc. and subsidiaries (the “Company”) as of December 31, 2019 and 2018, the related consolidated statements of income, comprehensive income, stockholders’ equity, and cash flows for each of the three years in the period ended December 31, 2019, and the related notes and the schedule listed in the Index at Item 15 (collectively referred to as the “financial statements”). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2019 and 2018, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2019, in conformity with accounting principles generally accepted in the United States of America.

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company’s internal control over financial reporting as of December 31, 2019, based on criteria established in *Internal Control-Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission and our report dated February 27, 2020, expressed an unqualified opinion on the Company’s internal control over financial reporting.

Change in Accounting Principle

As discussed in Note 2 to the financial statements, the Company has changed its method of accounting for leases in 2019 due to the adoption of the new leasing standard. The Company adopted the new leasing standard using a modified retrospective approach.

As discussed in Note 3 to the financial statements, the Company has changed its method of accounting for revenue from contracts with customers in 2018 due to the adoption of the new revenue standard. The Company adopted the new revenue standard using a modified retrospective approach.

Basis for Opinion

These financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the Company’s financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matters

The critical audit matters communicated below are matters arising from the current-period audit of the financial statements that were communicated or required to be communicated to the audit committee and that (1) relate to accounts or disclosures that are material to the financial statements and (2) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the financial statements, taken as a whole, and we are not, by communicating the critical audit matters below, providing separate opinions on the critical audit matters or on the accounts or disclosures to which they relate.

Revenue—Time-Based Lease Licenses—Refer to Notes 2 and 3 to the financial statements

Critical Audit Matter Description

The Company sells time-based lease (TBL) licenses that are a bundled arrangement that include the rights to a term software license as well as post-contract support (PCS). Revenue is recognized up front at the commencement of the lease for the term software license and recognized ratably over the term of the contract for the PCS in the arrangement. Utilizing observable

inputs, the Company determined that 50% of the estimated standalone selling price of the TBL is attributable to the term software license, while 50% is attributable to PCS. This determination involved judgment, particularly as it relates to the value relationship between the Company's PCS to TBLs, the value relationship between PCS and the Company's perpetual licenses and its linkage to the shortened term of a TBL, the average economic life of the Company's software, renewal rates of its customers, and the price of the bundled arrangement in relation to the perpetual licensing approach.

Given the judgments necessary to determine the allocation between the term software license and PCS, auditing this estimate involved a high degree of auditor judgment.

How the Critical Audit Matter Was Addressed in the Audit

Our audit procedures related to management's estimate of the allocation between the term software license and PCS in a TBL included the following, among others:

- We tested the effectiveness of controls over TBL revenue, including those over the determination of the estimated standalone selling price of the Company's licenses and services, as well as the allocation of this standalone selling price within the arrangement.
- We evaluated the pricing relationship between PCS and perpetual licenses on the net licensing fee of the arrangement, as well as the Company's renewal rate of PCS sales on perpetual licenses through those arrangements selected for testing that contained both elements as a consideration point of the value relationship between the term software license and PCS when a customer purchases a bundled TBL.
- We evaluated the estimated economic life of the Company's software through observable data points.
- Through our current and historical audit procedures, we confirmed that the term software license portion and PCS portion of an arrangement are not sold separately from one another.
- We selected a sample of arrangements and performed the following:
 - Compared the list price of the TBL to the consideration received from the customer and recalculated the discount from list price for each arrangement
 - Evaluated whether management appropriately calculated the estimated standalone selling price for the TBL
 - Tested management's identification of distinct performance obligations
 - Tested the mathematical accuracy of revenue recognized at a point in time or over time based upon the identification of TBLs within the arrangement

Acquisitions—Livermore Software Technology, LLC— Developed Software and Core Technologies Intangible Asset—Refer to Notes 2 and 4 to the financial statements

Critical Audit Matter Description

The Company completed the acquisition of Livermore Software Technology, LLC for \$777.8 million on November 1, 2019. The Company accounted for the acquisition under the acquisition method of accounting for business combinations. Accordingly, the purchase price was allocated to the assets acquired and liabilities assumed based on their respective fair values, including the developed software and core technologies intangible asset of \$167.7 million. Management estimated the fair value of the developed software and core technologies intangible asset using the relief from royalty method. The fair value determination of the developed software and core technologies intangible asset required management to make significant estimates and assumptions related to the royalty rate, revenue growth rate, and the selection of the discount rate.

Given the fair value determination of the developed software and core technologies intangible asset requires management to make significant estimates and assumptions related to the selected royalty rate, forecasts of future revenue growth, and the selection of the discount rate, performing audit procedures to evaluate the reasonableness of these estimates and assumptions required a high degree of auditor judgment and an increased extent of effort, including the need to involve our fair value specialists.

How the Critical Audit Matter Was Addressed in the Audit

Our audit procedures related to the selection of the royalty rate, forecasts of future revenue growth, and the selection of the discount rate for the developed software and core technologies intangible asset included the following, among others:

- We tested the effectiveness of controls over the valuation of the developed software and core technologies intangible asset, including management’s controls over the selection of the royalty rate, forecasts of future revenue growth, and selection of the discount rate.
- We assessed the reasonableness of management’s forecasts of future revenue growth by comparing the projections to historical results and certain industry data.
- We selected a sample of historical revenue transactions included within the valuation model and evaluated the appropriate recognition of revenue within the relevant period.
- With the assistance of our fair value specialists, we evaluated the reasonableness of the (1) valuation methodology, (2) royalty rate, and (3) discount rate by:
 - Testing the source information underlying the determination of the discount rate and testing the mathematical accuracy of the calculation
 - Evaluating the selected royalty rate against market data of comparable licensing agreements, as well as historical licensing agreements
 - Developing a range of independent estimates and comparing those to the discount rate selected by management

/s/ Deloitte & Touche LLP

Pittsburgh, Pennsylvania

February 27, 2020

We have served as the Company's auditor since 2002.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Stockholders and the Board of Directors of ANSYS, Inc.

Opinion on Internal Control over Financial Reporting

We have audited the internal control over financial reporting of ANSYS, Inc. and subsidiaries (the “Company”) as of December 31, 2019, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2019, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by COSO.

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated financial statements as of and for the year ended December 31, 2019, of the Company and our report dated February 27, 2020, expressed an unqualified opinion on those financial statements.

Basis for Opinion

The Company’s management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management’s Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company’s internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and Limitations of Internal Control over Financial Reporting

A company’s internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company’s internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company’s assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

/s/ Deloitte & Touche LLP
Pittsburgh, Pennsylvania
February 27, 2020

ANSYS, INC. AND SUBSIDIARIES
CONSOLIDATED BALANCE SHEETS

<i>(in thousands, except share and per share data)</i>	December 31,	
	2019	2018
ASSETS		
Current assets:		
Cash and cash equivalents	\$ 872,094	\$ 777,139
Short-term investments	288	225
Accounts receivable, less allowance for doubtful accounts of \$8,700 and \$8,000, respectively	433,479	317,700
Other receivables and current assets	249,619	216,113
Total current assets	1,555,480	1,311,177
Long-term assets:		
Property and equipment, net	83,636	61,655
Operating lease right-of-use assets	105,671	—
Goodwill	2,413,280	1,572,455
Other intangible assets, net	476,711	211,272
Other long-term assets	180,032	82,775
Deferred income taxes	24,077	26,630
Total long-term assets	3,283,407	1,954,787
Total assets	\$ 4,838,887	\$ 3,265,964
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	\$ 14,298	\$ 7,953
Accrued bonuses and commissions	101,546	79,945
Accrued income taxes	9,996	8,726
Current portion of long-term debt	75,000	—
Other accrued expenses and liabilities	142,947	99,559
Deferred revenue	351,353	328,584
Total current liabilities	695,140	524,767
Long-term liabilities:		
Deferred income taxes	78,643	30,077
Long-term operating lease liabilities	91,768	—
Long-term debt	423,531	—
Other long-term liabilities	96,426	61,573
Total long-term liabilities	690,368	91,650
Commitments and contingencies		
Stockholders' equity:		
Preferred stock, \$.01 par value; 2,000,000 shares authorized; zero shares issued or outstanding	—	—
Common stock, \$.01 par value; 300,000,000 shares authorized; 94,627,585 and 93,236,023 shares issued, respectively	946	932
Additional paid-in capital	1,188,939	867,462
Retained earnings	3,370,706	2,919,411
Treasury stock, at cost: 8,893,177 and 9,601,670 shares, respectively	(1,041,831)	(1,075,879)
Accumulated other comprehensive loss	(65,381)	(62,379)
Total stockholders' equity	3,453,379	2,649,547
Total liabilities and stockholders' equity	\$ 4,838,887	\$ 3,265,964

The accompanying notes are an integral part of the consolidated financial statements.

ANSYS, INC. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF INCOME

<i>(in thousands, except per share data)</i>	Year Ended December 31,		
	2019	2018	2017
Revenue:			
Software licenses	\$ 699,630	\$ 576,717	\$ 624,964
Maintenance and service	816,262	716,919	470,286
Total revenue	<u>1,515,892</u>	<u>1,293,636</u>	<u>1,095,250</u>
Cost of sales:			
Software licenses	23,944	18,619	34,421
Amortization	21,710	27,034	36,794
Maintenance and service	120,619	110,232	78,949
Total cost of sales	<u>166,273</u>	<u>155,885</u>	<u>150,164</u>
Gross profit	<u>1,349,619</u>	<u>1,137,751</u>	<u>945,086</u>
Operating expenses:			
Selling, general and administrative	521,200	413,580	338,640
Research and development	298,210	233,802	202,746
Amortization	15,169	13,795	12,972
Total operating expenses	<u>834,579</u>	<u>661,177</u>	<u>554,358</u>
Operating income	<u>515,040</u>	<u>476,574</u>	<u>390,728</u>
Interest income	12,796	11,419	6,962
Interest expense	(3,461)	(59)	(86)
Other expense, net	(1,792)	(849)	(1,910)
Income before income tax provision	<u>522,583</u>	<u>487,085</u>	<u>395,694</u>
Income tax provision	71,288	67,710	136,443
Net income	<u>\$ 451,295</u>	<u>\$ 419,375</u>	<u>\$ 259,251</u>
Earnings per share – basic:			
Earnings per share	<u>\$ 5.36</u>	<u>\$ 4.99</u>	<u>\$ 3.05</u>
Weighted average shares	<u>84,259</u>	<u>83,973</u>	<u>84,988</u>
Earnings per share – diluted:			
Earnings per share	<u>\$ 5.25</u>	<u>\$ 4.88</u>	<u>\$ 2.98</u>
Weighted average shares	<u>85,925</u>	<u>85,913</u>	<u>86,854</u>

The accompanying notes are an integral part of the consolidated financial statements.

ANSYS, INC. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

<i>(in thousands)</i>	Year Ended December 31,		
	2019	2018	2017
Net income	\$ 451,295	\$ 419,375	\$ 259,251
Other comprehensive (loss) income:			
Foreign currency translation adjustments	(3,002)	(24,535)	19,808
Comprehensive income	\$ 448,293	\$ 394,840	\$ 279,059

The accompanying notes are an integral part of the consolidated financial statements.

ANSYS, INC. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF CASH FLOWS

<i>(in thousands)</i>	Year Ended December 31,		
	2019	2018	2017
Cash flows from operating activities:			
Net income	\$ 451,295	\$ 419,375	\$ 259,251
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation and amortization	60,516	59,255	67,678
Operating lease right-of-use assets amortization	18,459	—	—
Deferred income tax benefit	(14,511)	(33,675)	(2,693)
Provision for bad debts	2,928	1,577	1,474
Stock-based compensation expense	116,190	83,346	53,154
Other	2,778	410	21
Changes in operating assets and liabilities:			
Accounts receivable	(154,403)	(74,455)	(14,406)
Other receivables and current assets	(26,182)	(30,241)	(18,498)
Other long-term assets	(5,622)	1,839	(435)
Accounts payable, accrued expenses and current liabilities	38,543	19,920	27,045
Accrued income taxes	575	1,086	1,215
Deferred revenue	17,245	56,213	20,648
Other long-term liabilities	(7,875)	(19,662)	33,206
Net cash provided by operating activities	499,936	484,988	427,660
Cash flows from investing activities:			
Acquisitions, net of cash acquired	(787,196)	(283,026)	(63,885)
Capital expenditures	(44,940)	(21,762)	(19,149)
Other investing activities	(1,412)	(7,443)	(11,631)
Net cash used in investing activities	(833,548)	(312,231)	(94,665)
Cash flows from financing activities:			
Proceeds from long-term debt	500,000	—	—
Purchase of treasury stock	(59,116)	(269,801)	(336,042)
Restricted stock withholding taxes paid in lieu of issued shares	(42,431)	(28,879)	(11,112)
Proceeds from shares issued for stock-based compensation	34,093	41,019	52,503
Other financing activities	(3,137)	(5,014)	—
Net cash provided by (used in) financing activities	429,409	(262,675)	(294,651)
Effect of exchange rate fluctuations on cash and cash equivalents	(842)	(14,444)	20,678
Net increase (decrease) in cash and cash equivalents	94,955	(104,362)	59,022
Cash and cash equivalents, beginning of period	777,139	881,501	822,479
Cash and cash equivalents, end of period	\$ 872,094	\$ 777,139	\$ 881,501
Supplemental disclosures of cash flow information:			
Income taxes paid	\$ 86,770	\$ 87,244	\$ 116,389
Interest paid	\$ 787	\$ 114	\$ 199
Fair value of common stock issued as consideration in connection with acquisitions	\$ 307,173	\$ —	\$ —

The accompanying notes are an integral part of the consolidated financial statements.

ANSYS, INC. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY

<i>(in thousands)</i>	Common Stock		Additional Paid-In Capital	Retained Earnings	Treasury Stock		Accumulated Other Comprehensive (Loss)/Income	Total Stockholders' Equity
	Shares	Amount			Shares	Amount		
Balance, January 1, 2017	93,236	\$ 932	\$ 883,010	\$ 2,057,665	7,548	\$ (675,550)	\$ (57,652)	\$ 2,208,405
Treasury shares acquired					2,750	(336,042)		(336,042)
Stock-based compensation activity			(9,653)		(1,254)	104,062		94,409
Other comprehensive income							19,808	19,808
Net income for the year				259,251				259,251
Balance, December 31, 2017	93,236	932	873,357	2,316,916	9,044	(907,530)	(37,844)	2,245,831
Cumulative effect of the ASC 606 adoption				183,120				183,120
Treasury shares acquired					1,674	(269,801)		(269,801)
Stock-based compensation activity			(5,895)		(1,116)	101,452		95,557
Other comprehensive loss							(24,535)	(24,535)
Net income for the year				419,375				419,375
Balance, December 31, 2018	93,236	932	867,462	2,919,411	9,602	(1,075,879)	(62,379)	2,649,547
Acquisition of Livermore Software Technology, LLC	1,392	14	307,159					307,173
Treasury shares acquired					330	(59,116)		(59,116)
Stock-based compensation activity			14,318		(1,039)	93,164		107,482
Other comprehensive loss							(3,002)	(3,002)
Net income for the year				451,295				451,295
Balance, December 31, 2019	94,628	\$ 946	\$ 1,188,939	\$ 3,370,706	8,893	\$(1,041,831)	\$ (65,381)	\$ 3,453,379

The accompanying notes are an integral part of the consolidated financial statements.

ANSYS, INC. AND SUBSIDIARIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
December 31, 2019

1. Organization

We develop and globally market engineering simulation software and services widely used by engineers, designers, researchers and students across a broad spectrum of industries and academia, including aerospace and defense, automotive, electronics, semiconductors, energy, materials and chemical processing, turbomachinery, consumer products, healthcare, and sports.

As defined by the accounting guidance for segment reporting, we operate as one segment.

Given the integrated approach to the multi-discipline problem-solving needs of our customers, a single sale of software may contain components from multiple product areas and include combined technologies. We also have a multi-year product and integration strategy that will result in new, combined products or changes to the historical product offerings. As a result, it is impracticable for us to provide accurate historical or current reporting among our various product lines.

2. Accounting Policies

Accounting Principles

The financial statements and accompanying notes are prepared in accordance with accounting principles generally accepted in the United States. Certain items in the consolidated financial statements and the notes to the consolidated financial statements of prior years have been reclassified to conform to the current year's presentation. These reclassifications had no effect on reported net income, comprehensive income, cash flows, total assets or total liabilities and stockholders' equity.

Principles of Consolidation

The accompanying consolidated financial statements include our accounts and those of our wholly owned subsidiaries. All intercompany accounts and transactions have been eliminated.

Recently Adopted Accounting Guidance

Leases: In February 2016, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update (ASU) No. 2016-02, *Leases (Topic 842)* (ASU 2016-02). We adopted ASU 2016-02 and its related amendments (collectively known as Accounting Standards Codification (ASC) 842) on January 1, 2019 using the modified retrospective approach. Results for reporting periods beginning after January 1, 2019 are presented under ASC 842, while prior period amounts are not adjusted and continue to be reported in accordance with ASC 840, *Leases*. ASC 842 requires virtually all leases, other than leases of intangible assets, to be recorded on the balance sheet with a right-of-use (ROU) asset and a corresponding lease liability.

We elected the package of practical expedients permitted under the transition guidance within the new standard, which allowed us to carry forward our historical assessments of whether a contract contains a lease, lease classification and initial direct costs. In addition, we elected the accounting policy to combine the lease and nonlease components as a single component for all asset classes.

We determine if an arrangement is a lease at inception. Leases are classified as either operating or finance leases based on certain criteria. This classification determines the timing and presentation of expenses on the income statement, as well as the presentation of the related cash flows and balance sheet. Operating leases are recorded on the balance sheet as operating lease right-of-use assets, other accrued expenses and liabilities, and long-term operating lease liabilities. We currently have no finance leases.

ROU assets and related liabilities are recorded at lease commencement based on the present value of the lease payments over the expected lease term. Lease payments include future increases unless the increases are based on changes in an index or rate. As our leases do not usually provide an implicit rate, our incremental borrowing rate is used to calculate ROU assets and related liabilities. The incremental borrowing rate is determined based on our estimated credit rating, the term of the lease, the economic environment where the asset resides and full collateralization. The ROU assets and related lease liabilities include optional renewals for which we are reasonably certain to exercise; whereas, optional terminations are included unless it is reasonably certain not to be elected.

The adoption of the new standard resulted in the recognition of ROU assets of \$90.9 million and lease liabilities of \$92.5 million, and corresponding deferred tax assets and liabilities, on our consolidated balance sheet as of January 1, 2019. The adoption had no impact on our consolidated statements of income or cash flows.

Implementation cost accounting for cloud computing arrangements: In August 2018, the FASB issued ASU No. 2018-15, *Intangibles—Goodwill and Other—Internal-Use Software (Subtopic 350-40): Customer's Accounting for Implementation Costs Incurred in a Cloud Computing Arrangement That Is a Service Contract* (ASU 2018-15). The standard aligns the accounting for costs incurred to implement a cloud computing arrangement (CCA) that is a service arrangement with the guidance on capitalizing costs associated with developing or obtaining internal-use software. Under ASU 2018-15, an entity would apply Subtopic 350-40 to determine which implementation costs related to a CCA that is a service contract should be capitalized. The standard does not change the accounting for the service component of a CCA. The associated cash flows will be reflected within operating activities.

We retrospectively adopted the guidance during the quarter ended December 31, 2019. The adoption resulted in the reclassification of cash flows associated with implementation costs related to CCAs that are service contracts on our consolidated statements of cash flows. This resulted in a decrease to operating cash flows, and a corresponding increase to investing cash flows, of \$2.5 million, \$1.4 million and \$2.8 million for the years ending December 31, 2019, 2018 and 2017, respectively. The adoption had no impact on our consolidated balance sheets or consolidated statements of income.

Accounting Guidance Issued and Not Yet Adopted

Credit losses: In June 2016, the FASB issued ASU No. 2016-13, *Financial Instruments - Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments* (ASU 2016-13). The current guidance requires the allowance for doubtful accounts to be estimated based on an incurred loss model, which considers past and current conditions. ASU 2016-13 requires companies to use an expected loss model that also considers reasonable and supportable forecasts of future conditions. ASU 2016-13 is effective for annual periods beginning after December 15, 2019, including interim periods within that reporting period. Early adoption is permitted for annual periods beginning after December 15, 2018, including interim periods within that reporting period. The standard requires a cumulative-effect adjustment to the balance sheet as of the beginning of the first reporting period in which the guidance is effective. We will adopt the standard effective January 1, 2020 and do not expect the adoption of the new standard to have a material effect on our consolidated financial statements.

Income taxes: In December 2019, the FASB issued ASU No. 2019-12, *Income Taxes (Topic 740): Simplifying the Accounting for Income Taxes* (ASU 2019-12), as part of its initiative to reduce complexity in the accounting standards. The amendments in ASU 2019-12 eliminate certain exceptions related to the approach for intraperiod tax allocation, the methodology for calculating income taxes in an interim period and the recognition of deferred tax liabilities for outside basis differences. ASU 2019-12 also clarifies and simplifies other aspects of the accounting for income taxes. ASU 2019-12 is effective for fiscal years, and interim periods within those fiscal years, beginning after December 15, 2020. Early adoption is permitted, including adoption in any interim period. We are currently evaluating the impact that this guidance will have upon our financial position and results of operations, if any.

Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements. Estimates also affect the amounts of revenue and expenses during the reported periods. Significant estimates included in these consolidated financial statements include:

- Allowances for doubtful accounts receivable
- Income tax accruals, including those related to the Tax Cuts and Jobs Act
- Uncertain tax positions
- Tax valuation reserves
- Fair value of stock-based compensation and probabilities of performance award attainment
- Contract revenue
- Standalone selling prices of our products and services
- Acquired deferred revenue
- Useful lives for depreciation and amortization
- Valuations of goodwill and other intangible assets
- Deferred compensation

- Loss contingencies
- Operating lease assets and liabilities

Actual results could differ from these estimates. Changes in estimates are recorded in the results of operations in the period that the changes occur.

Revenue Recognition

Our revenue is derived principally from the licensing of computer software products and from related maintenance contracts. We adopted ASC 606 on January 1, 2018. ASC 606 requires an entity to evaluate revenue recognition by identifying a contract with a customer, identifying the performance obligations in the contract, determining the transaction price, allocating the transaction price to the performance obligations in the contract, and recognizing revenue when (or as) the entity satisfies a performance obligation.

Revenue Recognition Policy 2019 and 2018 (ASC 606)

We enter into contracts that include combinations of products, maintenance and services, which are accounted for as separate performance obligations with differing revenue recognition patterns.

Revenue from perpetual licenses is classified as software license revenue. Software license revenue is recognized up front upon delivery of the licensed product and/or the utility that enables the customer to access authorization keys, provided that an enforceable contract has been received. Typically, our perpetual licenses are sold with post-contract support (PCS), which includes unspecified technical enhancements and customer support. We allocate value in bundled perpetual and PCS arrangements based on the standalone selling prices of the perpetual license and PCS. Revenue from PCS is classified as maintenance revenue and is recognized ratably over the term of the contract, as we satisfy the PCS performance obligation over time.

In addition to perpetual licenses, we sell time-based lease licenses. Lease licenses are sold only as a bundled arrangement that includes the rights to a term software license and PCS. Utilizing observable inputs, we determined that 50% of the estimated standalone selling price of the lease license is attributable to the term license and 50% is attributable to the PCS. This determination considered the value relationship for our products between PCS to time-based lease licenses, the value relationship between PCS and perpetual licenses, the average economic life of our products, software renewal rates and the price of the bundled arrangement in relation to the perpetual licensing approach. Consistent with the perpetual sales, the license component is classified as software license revenue and recognized as revenue up front at the commencement of the lease upon delivery of the licensed product and/or utility that enables the customer to access authorization keys. The PCS is classified as maintenance revenue and is recognized ratably over the term of the contract, as we satisfy the PCS performance obligation over time.

Revenue from training, support and other services is recognized as the services are performed. For contracts in which the service consists of a single performance obligation, such as providing a training class to a customer, we recognize revenue upon completion of the performance obligation. For service contracts that are longer in duration and often include multiple performance obligations (for example, both training and consulting), we measure the progress toward completion of the obligations and recognize revenue accordingly. In measuring progress towards the completion of performance obligations, we typically utilize output-based estimates for services with contractual billing arrangements that are not based on time and materials, and estimate output based on the total tasks completed as compared to the total tasks required for each work contract. Input-based estimates are utilized for services that involve general consultations with contractual billing arrangements based on time and materials, utilizing direct labor as the input measure. Proceeds from customers for the purpose of expediting road-map items, developing new products or creating specific features and functionality for existing products is classified as revenue.

We also execute arrangements through independent channel partners in which the channel partners are authorized to market and distribute our software products to end users of our products and services in specified territories. In sales facilitated by channel partners, the channel partner bears the risk of collection from the end-user customer. We recognize revenue from transactions with channel partners in a manner consistent with the direct sales described above for both perpetual and time-based licenses. Revenue from channel partner transactions is the amount remitted to us by the channel partners. This amount includes a fee for PCS that is compensation for providing technical enhancements and the second level of technical support to the end user, which is recognized over the period that PCS is to be provided.

Non-income related taxes collected from customers and remitted to governmental authorities are recorded on the consolidated balance sheet as accounts receivable and accrued expenses. The collection and payment of these amounts are reported on a net basis in the consolidated statements of income and do not impact reported revenues or expenses.

We do not offer right of return. We warrant to our customers that our software will perform substantially as specified in our current user manuals. We have not experienced significant claims related to software warranties beyond the scope of

maintenance support, which we are already obligated to provide. The warranty is not sold, and cannot be purchased, separately. The warranty does not provide any type of additional service to the customer or performance obligation for us.

Our agreements with our customers generally require us to indemnify the customer against claims that our software infringes third-party patent, copyright, trademark or other proprietary rights. Such indemnification obligations are generally limited in a variety of industry-standard respects, including our right to replace an infringing product.

Significant Judgments (ASC 606)

Our contracts with customers typically include promises to transfer licenses and services to a customer. Judgment is required to determine if the promises are separate performance obligations, and if so, to allocate the transaction price to each performance obligation. We use the estimated standalone selling price method to allocate the transaction price for each performance obligation. The estimated standalone selling price is determined using all information reasonably available to us, including market conditions and other observable inputs. The corresponding revenues are recognized as the related performance obligations are satisfied.

We apply a practical expedient to expense sales commissions as incurred when the amortization period would have been one year or less. Sales commissions associated with the initial year of multi-year contracts are expensed as incurred due to their immateriality. Sales commissions associated with multi-year contracts beyond the initial year are subject to an employee service requirement and are expensed as incurred as they are not considered incremental costs to obtain a contract.

We are required to adjust promised amounts of consideration for the effects of the time value of money if the timing of the payments provides the customer or us with a significant financing benefit. We consider various factors in assessing whether a financing component exists, including the duration of the contract, market interest rates and the timing of payments. Our contracts do not include a significant financing component requiring adjustment to the transaction price.

Revenue Recognition Policy 2017 (ASC 605)

Revenue from perpetual licenses was classified as license revenue and was recognized upon delivery of the licensed product and/or the utility that enabled the customer to access authorization keys, provided that acceptance had occurred and a signed contractual obligation was received, the price was fixed and determinable, and collectibility of the receivable was probable. We determined the fair value of PCS sold together with perpetual licenses based on the rate charged for PCS when sold separately. Revenue from PCS contracts was classified as maintenance and service revenue and was recognized ratably over the term of the contract.

Revenue for software lease licenses was classified as license revenue and was recognized over the period of the lease contract. Typically, our software leases include PCS which, due to the short term (principally one year or less) of our software lease licenses, were not permitted to be separated from lease revenue for accounting purposes. As a result, both the lease licenses and PCS were recognized ratably over the lease period. We included the revenue for the entire lease arrangement within software license revenue in the consolidated statements of income.

Many of our semiconductor products are typically licensed via longer term leases of 24–36 months. We recognized revenue for these licenses over the term of the lease contract. Because we did not have vendor-specific objective evidence of the fair value of these leases, we also recognized revenue from perpetual licenses over the term of the lease contract during the infrequent occurrence of these licenses being sold with semiconductor leases in multiple-element arrangements.

Revenue from training, support and other services was recognized as the services were performed. We applied the specific performance method to contracts in which the service consisted of a single act, such as providing a training class to a customer, and the proportional performance method to other service contracts that were longer in duration and often included multiple acts (for example, both training and consulting). In applying the proportional performance method, we typically utilized output-based estimates for services with contractual billing arrangements that were not based on time and materials, and estimated output based on the total tasks completed as compared to the total tasks required for each work contract. Input-based estimates were utilized for services that involved general consultations with contractual billing arrangements based on time and materials, utilizing direct labor as the input measure.

The accounting treatment under ASC 605 associated with arrangements through independent channel partners, non-income related taxes, warranties and indemnification obligations is consistent with the accounting treatment under ASC 606 described above.

Cash and Cash Equivalents

Cash and cash equivalents consist primarily of highly liquid investments such as deposits held at major banks and money market funds. Cash equivalents are carried at cost, which approximates fair value. Our cash and cash equivalents balances comprise the following:

<i>(in thousands, except percentages)</i>	December 31, 2019		December 31, 2018	
	Amount	% of Total	Amount	% of Total
Cash accounts	\$ 549,639	63.0	\$ 331,084	42.6
Money market funds	322,455	37.0	446,055	57.4
Total	<u>\$ 872,094</u>		<u>\$ 777,139</u>	

Our money market fund balances are held in various funds of a single issuer.

Property and Equipment

Property and equipment is stated at cost. Depreciation is computed using the straight-line method over the estimated useful lives of the various classes of assets, which range from one year to forty years. Repairs and maintenance are charged to expense as incurred. Gains or losses from the sale or retirement of property and equipment are included in operating income.

Research and Development

Research and development costs are expensed as incurred. Internally developed software costs required to be capitalized as defined by the accounting guidance are not material to our consolidated financial statements.

Business Combinations

When we consummate an acquisition, the assets acquired and the liabilities assumed are recognized separately from goodwill at their acquisition date fair values. Goodwill as of the acquisition date is measured as the excess of the fair value of consideration transferred over the acquisition date fair value of the net identifiable assets acquired. While best estimates and assumptions are used to accurately value assets acquired and liabilities assumed at the acquisition date as well as contingent consideration, where applicable, our estimates are inherently uncertain and subject to refinement. As a result, during the measurement period, which may be up to one year from the acquisition date, we record adjustments to the assets acquired and liabilities assumed with the corresponding offset to goodwill as we obtain new information about facts and circumstances that existed as of the acquisition date that, if known, would have affected the measurement of the amounts recognized as of that date. Upon the earlier of the conclusion of the measurement period or final determination of the values of assets acquired or liabilities assumed, any subsequent adjustments are recorded in the consolidated statements of income.

Goodwill and Other Intangible Assets

Goodwill represents the excess of the fair value of consideration transferred over the fair value of net identifiable assets acquired. Other intangible assets consist of trade names, customer lists, contract backlog and acquired software and technology. Intangible assets that are not considered to have an indefinite useful life are amortized over their useful lives, which range from two years to seventeen years. Amortization expense for intangible assets was \$36.9 million, \$40.8 million and \$49.8 million for the years ended December 31, 2019, 2018 and 2017, respectively.

We test goodwill and indefinite-lived intangible assets for impairment at least annually by performing a quantitative assessment of whether the fair value of each reporting unit or asset exceeds its carrying amount. We have one reporting unit. Goodwill is tested at this reporting unit level and indefinite-lived intangible assets are tested at the individual asset level. This requires us to assess and make judgments regarding a variety of factors which impact the fair value of the reporting unit or asset being tested, including business plans, anticipated future cash flows, economic projections and other market data.

We perform our annual impairment tests for goodwill and indefinite-lived intangible assets as of January 1 of each year unless there is an indicator that would require a test during the year. We periodically review the carrying value of other intangible assets and will recognize impairments when events or circumstances indicate that such assets may be impaired.

Concentrations of Credit Risk

We have a concentration of credit risk with respect to revenue and trade receivables due to the use of certain significant channel partners to market and sell our products. We perform periodic credit evaluations of our customers' financial condition and generally do not require collateral. The following table outlines concentrations of risk with respect to our revenue:

<i>(as a % of revenue)</i>	Year Ended December 31,		
	2019	2018	2017
Revenue from channel partners	23%	22%	25%
Largest channel partner	4%	4%	5%
2 nd largest channel partner	2%	2%	2%

No single customer accounted for more than 5% of our revenue in 2019, 2018 or 2017.

In addition to the concentration of credit risk with respect to trade receivables, our cash and cash equivalents are also exposed to concentration risk. Our cash and cash equivalent accounts are insured through various public and private bank deposit insurance programs, foreign and domestic; however, a significant portion of our funds are not insured. The following table outlines concentrations of risk with respect to our cash and cash equivalents:

<i>(in thousands)</i>	As of December 31,	
	2019	2018
Cash and cash equivalents held domestically	\$ 626,433	\$ 616,249
Cash and cash equivalents held by foreign subsidiaries	245,661	160,890
Cash and cash equivalents held in excess of deposit insurance, foreign and domestic	855,721	754,163
Largest balance of cash and cash equivalents held with one financial institution, foreign and domestic	330,551	452,166

Allowance for Doubtful Accounts

We make judgments as to our ability to collect outstanding receivables and provide allowances for a portion of receivables when collection becomes doubtful. Provisions are made based upon a specific review of all significant outstanding invoices from both value and delinquency perspectives. For those invoices not specifically reviewed, provisions are estimated at differing rates based upon the age of the receivable and the geographic area of origin. In determining these percentages, we consider our historical collection experience and current economic trends in the customer's industry and geographic region. We recorded provisions for bad debts of \$2.9 million, \$1.6 million and \$1.5 million for the years ended December 31, 2019, 2018 and 2017, respectively.

Income Taxes

We account for income taxes under the asset and liability method, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of events that have been included in the financial statements. Under this method, deferred tax assets and liabilities are determined based on the differences between the financial statement and tax bases of assets and liabilities using enacted tax rates in effect for the year in which the differences are expected to reverse. The effect of a change in tax rates on deferred tax assets and liabilities is recognized in income in the period of the enactment date.

We record net deferred tax assets to the extent we believe these assets will more likely than not be realized. In making such determination, we consider all available positive and negative evidence, including scheduled reversals of deferred tax liabilities, projected future taxable income, tax planning strategies and recent financial operations. In the event we determine that we will be able to realize deferred tax assets for which a valuation allowance was used to reduce their carrying value, the adjustment to the valuation allowance will be recorded as a reduction to the provision for income taxes.

Tax benefits related to uncertain tax positions taken or expected to be taken on a tax return are recorded when such benefits meet a more-likely-than-not threshold. Otherwise, these tax benefits are recorded when a tax position has been effectively settled, which means that the statute of limitations has expired or the appropriate taxing authority has completed its examination even though the statute of limitations remains open.

We recognize interest and penalties related to income taxes within the income tax expense line in the consolidated statements of income. Accrued interest and penalties are included within the related tax liability line in the consolidated balance sheets.

Foreign Currencies

Certain of our sales and intercompany transactions are denominated in foreign currencies. These transactions are translated to the functional currency at the exchange rate on the transaction date. Assets and liabilities denominated in a currency other than our functional currency or our subsidiaries' functional currencies are translated at the effective exchange rate on the balance sheet date. Gains and losses resulting from foreign exchange transactions are included in other expense, net. We recorded net foreign exchange losses of \$2.5 million, \$3.1 million and \$1.9 million for the years ended December 31, 2019, 2018 and 2017, respectively.

The financial statements of our foreign subsidiaries are translated from the functional (local) currency to U.S. Dollars. Assets and liabilities are translated at the exchange rates on the balance sheet date. Results of operations are translated at average exchange rates, which approximate rates in effect when the underlying transactions occurred.

Accumulated Other Comprehensive Loss

Accumulated other comprehensive loss is composed entirely of foreign currency translation adjustments.

Earnings Per Share

Basic earnings per share (EPS) amounts are computed by dividing earnings by the weighted average number of common shares outstanding during the period. Diluted EPS amounts assume the issuance of common stock for all potentially dilutive equivalents outstanding. To the extent stock awards are anti-dilutive, they are excluded from the calculation of diluted EPS.

The details of basic and diluted EPS are as follows:

<i>(in thousands, except per share data)</i>	Year Ended December 31,		
	2019	2018	2017
Net income	\$ 451,295	\$ 419,375	\$ 259,251
Weighted average shares outstanding – basic	84,259	83,973	84,988
Dilutive effect of stock plans	1,666	1,940	1,866
Weighted average shares outstanding – diluted	85,925	85,913	86,854
Basic earnings per share	\$ 5.36	\$ 4.99	\$ 3.05
Diluted earnings per share	\$ 5.25	\$ 4.88	\$ 2.98
Anti-dilutive shares	14	7	84

Stock-Based Compensation

We account for stock-based compensation in accordance with share-based payment accounting guidance. The guidance requires an entity to measure the cost of employee services received in exchange for an award of equity instruments based on the grant-date fair value of the award. The cost is recognized over the period during which an employee is required to provide services in exchange for the award, typically the vesting period.

Fair Value of Financial Instruments

We account for certain assets and liabilities at fair value in accordance with the accounting guidance applicable to fair value measurements and disclosures. The carrying values of cash, cash equivalents, short-term investments, accounts receivable, accounts payable, accrued expenses, other accrued liabilities and short-term obligations are deemed to be reasonable estimates of their fair values because of their short-term nature.

3. Revenue from Contracts with Customers

Adoption of ASC 606, Revenue from Contracts with Customers

We adopted ASC 606 on January 1, 2018 using the modified retrospective approach for all contracts not completed as of the date of adoption. Results for reporting periods beginning after January 1, 2018 are presented under ASC 606, while prior period amounts are not adjusted and continue to be reported in accordance with ASC 605. The adoption of ASC 606 represents a change in accounting principle that will more closely align revenue recognition with the delivery of our software licenses, maintenance and services.

We recorded an increase to retained earnings of \$242.4 million, or \$183.1 million net of tax, on January 1, 2018 due to the cumulative effect of the ASC 606 adoption, with the impact primarily derived from revenue related to time-based software lease licenses. Software lease license revenue was recognized ratably over the term of the contract under the previous guidance; however, approximately 50% of the contract is recognized up front at the commencement of the lease under ASC 606 with the remainder recognized ratably to maintenance and service revenue.

Disaggregation of Revenue

The following table summarizes revenue:

<i>(in thousands)</i>	Year Ended December 31,		
	2019 (ASC 606)	2018 (ASC 606)	2017 (ASC 605)
Revenue:			
Lease licenses	\$ 406,043	\$ 275,619	\$ 376,886
Perpetual licenses	293,587	301,098	248,078
Software licenses	699,630	576,717	624,964
Maintenance	760,574	676,883	440,428
Service	55,688	40,036	29,858
Maintenance and service	816,262	716,919	470,286
Total revenue	\$ 1,515,892	\$ 1,293,636	\$ 1,095,250
Direct revenue, as a percentage of total revenue	77.1%	77.6%	75.2%
Indirect revenue, as a percentage of total revenue	22.9%	22.4%	24.8%

Our software licenses revenue is recognized up front, while maintenance and service revenue is generally recognized over the term of the contract.

Deferred Revenue

Deferred revenue consists of billings made or payments received in advance of revenue recognition from customer agreements. The timing of revenue recognition may differ from the timing of billings to customers. Payment terms vary by the type and location of customer and the products or services offered. The time between invoicing and when payment is due is not significant.

The changes in deferred revenue, inclusive of both current and long-term deferred revenue, during the years ended December 31, 2019 and 2018 were as follows:

<i>(in thousands)</i>	2019	2018
Beginning balance – January 1	\$ 343,174	\$ 299,730
Acquired deferred revenue	6,880	2,470
Deferral of revenue	1,532,549	1,339,964
Recognition of deferred revenue	(1,515,892)	(1,293,636)
Currency translation	(1,437)	(5,354)
Ending balance – December 31	\$ 365,274	\$ 343,174

Revenue allocated to remaining performance obligations represents contracted revenue that has not yet been recognized, which includes both deferred revenue and backlog. Our backlog represents installment billings for periods beyond the current

quarterly billing cycle. Revenue recognized during the years ended December 31, 2019 and 2018 included amounts in deferred revenue and backlog at the beginning of the period of \$475.9 million and \$387.2 million, respectively.

Total revenue allocated to remaining performance obligations as of December 31, 2019 will be recognized as revenue as follows:

<i>(in thousands)</i>	
Next 12 months	\$ 569,751
Months 13-24	177,364
Months 25-36	93,097
Thereafter	30,531
Total revenue allocated to remaining performance obligations	<u>\$ 870,743</u>

4. Acquisitions

2019 Acquisitions

On November 1, 2019, we completed the acquisition of 100% of the shares of LST, the premier provider of explicit dynamics and other advanced finite element analysis technology. The acquisition empowers our customers to solve a new class of engineering challenges, including developing safer automobiles, aircraft and trains while reducing or even eliminating the need for costly physical testing. The transaction closed with a purchase price of \$777.8 million, which included \$470.6 million in cash and the issuance of 1.4 million shares of our common stock in an unregistered offering to the prior owners of LST. The fair value of the common stock issued as consideration was based on the volume-weighted average price of our common stock on November 1, 2019 of \$220.74, resulting in a fair value of \$307.2 million.

On February 1, 2019, we completed the acquisition of 100% of the shares of Granta Design for a purchase price of \$208.7 million, paid in cash and inclusive of final net working capital adjustments. The acquisition of Granta Design, the premier provider of materials information technology, expands our portfolio into this important area, giving customers access to materials intelligence, including data that is critical to successful simulations.

Additionally, during the year ended December 31, 2019, we acquired Dynardo, Helic and DfR Solutions to combine the acquired technologies with our existing comprehensive multiphysics portfolio. These acquisitions were not individually significant. The combined purchase price of these other acquisitions was \$136.2 million, paid in cash.

During the year ended December 31, 2019, we incurred \$6.6 million in acquisition-related expenses, recognized as selling, general and administrative expense on the consolidated statements of income.

The assets and liabilities of the acquisitions have been recorded based upon management's estimates of their fair market values as of each respective date of acquisition. The following tables summarize the fair values of consideration transferred and the fair values of identified assets acquired and liabilities assumed at each respective date of acquisition:

Fair Value of Consideration Transferred:

<i>(in thousands)</i>	LST	Granta Design	Other Acquisitions	Total
Cash	\$ 470,623	\$ 208,736	\$ 136,232	\$ 815,591
Ansys common stock	307,173	—	—	307,173
Total consideration transferred at fair value	<u>\$ 777,796</u>	<u>\$ 208,736</u>	<u>\$ 136,232</u>	<u>\$ 1,122,764</u>

Recognized Amounts of Identifiable Assets Acquired and Liabilities Assumed:

<i>(in thousands)</i>	LST	Granta Design	Other Acquisitions	Total
Cash	\$ 8,520	\$ 13,644	\$ 6,231	\$ 28,395
Accounts receivable and other tangible assets	20,568	6,941	10,746	38,255
Developed software and core technologies (10-year weighted-average life)	167,700	32,445	25,018	225,163
Customer lists (15-year weighted-average life)	25,900	20,016	15,743	61,659
Trade names (10-year weighted-average life)	10,600	4,579	2,051	17,230
Indemnification asset	34,039	—	—	34,039
Accounts payable and other liabilities	(3,721)	(6,714)	(6,425)	(16,860)
Deferred revenue	(3,565)	(1,426)	(1,889)	(6,880)
Uncertain tax positions	(34,039)	—	(257)	(34,296)
Net deferred tax liabilities	(47,596)	(9,822)	(8,294)	(65,712)
Total identifiable net assets	<u>\$ 178,406</u>	<u>\$ 59,663</u>	<u>\$ 42,924</u>	<u>\$ 280,993</u>
Goodwill	<u>\$ 599,390</u>	<u>\$ 149,073</u>	<u>\$ 93,308</u>	<u>\$ 841,771</u>

LST has uncertain tax positions inclusive of interest and penalties of \$34.0 million and a corresponding indemnification asset. The uncertain tax positions reflect potential federal and state tax liabilities associated with tax years 2016 to 2019. Settlements of the tax positions, if any, will be funded by the indemnification asset that was created in accordance with the executed Agreement and Plan of Merger.

The goodwill, which is generally not tax-deductible, is attributed to intangible assets that do not qualify for separate recognition, including the assembled workforce of the acquired business and the synergies expected to arise as a result of the acquisitions.

The fair values of the assets acquired and liabilities assumed are based on preliminary calculations. The estimates and assumptions for these items are subject to change as additional information about what was known and knowable at the acquisition date is obtained during the measurement period (up to one year from the acquisition date).

We determined the fair value of our intangible assets using various valuation techniques, including the relief-from-royalty method and the multi-period excess earnings method. These models utilize certain unobservable inputs classified as Level 3 measurements as defined by ASC 820, *Fair Value Measurements and Disclosures*. The determination of fair value requires considerable judgment and is sensitive to changes in underlying assumptions, estimates and market factors. Estimating fair value requires us to make assumptions and estimates regarding our future plans, as well as industry and economic conditions. These assumptions and estimates include, but are not limited to: royalty rate, discount rate and attrition rate.

The valuation method and assumptions used to determine the fair value of the significant intangible assets acquired in 2019 are as follows:

Intangible Asset	Valuation Method	LST Assumptions	Granta Design Assumptions
Developed software and core technologies	Relief-from-royalty	Royalty rate: 50% Discount rate: 10%	Royalty rate: 8% - 10% Discount rate: 12.5%
Trade names	Relief-from-royalty	Royalty rate: 2% Discount rate: 10%	Royalty rate: 2% Discount rate: 14%
Customer lists	Multi-period excess earnings	Attrition rate: 10% Discount rate: 11%	Attrition rate: 10% Discount rate: 12.5%

The operating results of each acquisition have been included in our consolidated financial statements since each respective date of acquisition. The effects of the business combinations were not material to our consolidated results of operations individually. The table presented below reflects the aggregate impact on our results of operations of the 2019 acquisitions from the date of acquisition to December 31, 2019. The operating income does not include integration costs borne directly by us and our non-acquired subsidiaries as a result of the acquisitions.

<i>(in thousands)</i>	Year Ended December 31, 2019	
Revenue	\$	44,079
Operating income	\$	6,733

2018 Acquisition

On May 2, 2018, we completed the acquisition of 100% of the shares of OPTIS, a premier provider of software for scientific simulation of light, human vision and physics-based visualization, for a purchase price of \$291.0 million, paid in cash. The acquisition extends our portfolio into the area of optical simulation to provide comprehensive sensor solutions, covering visible and infrared light, electromagnetics and acoustics for camera, radar and lidar.

The operating results of OPTIS have been included in our consolidated financial statements since May 2, 2018, the date of acquisition.

The assets and liabilities of OPTIS have been recorded based upon management's estimates of their fair market values as of the acquisition date. The following tables summarize the fair value of consideration transferred and the fair values of identified assets acquired and liabilities assumed at the acquisition date:

Fair Value of Consideration Transferred:

<i>(in thousands)</i>	OPTIS	
Cash	\$	290,983

Recognized Amounts of Identifiable Assets Acquired and Liabilities Assumed:

<i>(in thousands)</i>	OPTIS	
Cash	\$	7,957
Accounts receivable and other tangible assets		15,910
Developed software and core technologies (10-year weighted-average life)		47,597
Customer lists (12-year life)		41,303
Trade names (9-year weighted-average life)		10,749
Accounts payable and other liabilities		(11,941)
Deferred revenue		(2,470)
Net deferred tax liabilities		(23,438)
Total identifiable net assets	\$	85,667
Goodwill	\$	205,316

The goodwill, which is generally not tax-deductible, is attributed to intangible assets that do not qualify for separate recognition, including the assembled workforce of the acquired business and the synergies expected to arise as a result of the acquisition of OPTIS.

During the one-year measurement period since the OPTIS acquisition date, we adjusted the fair values of the assets acquired and liabilities assumed, with the offset recorded as a \$2.6 million increase to goodwill. These adjustments were made as we obtained new information about facts and circumstances that existed as of the acquisition date that, if known, would have affected the measurement of the amounts recognized as of that date.

Full pro forma results of operations have not been presented as the effects of the OPTIS business combination were not material to our consolidated results of operations. The table presented below reflects the impact of OPTIS from the date of acquisition to December 31, 2018. The operating loss does not include integration costs borne directly by us and our non-OPTIS subsidiaries as a result of the acquisition.

<i>(in thousands)</i>	Year Ended December 31, 2018	
Revenue	\$	18,532
Operating loss	\$	(5,462)

2017 Acquisitions

During the year ended December 31, 2017, we completed various acquisitions to expand our customer base and accelerate the development of new and innovative products to the marketplace while lowering design and engineering costs for customers. The acquisitions were not individually significant. The combined purchase price of the acquisitions was approximately \$67.0 million. The 2017 technology acquisitions are further described in the table below:

Date of Closing	Company	Details
November 15, 2017	3DSIM	3DSIM, a developer of premier additive manufacturing technology, gives us a complete additive manufacturing simulation workflow solution. 3DSIM's software solutions empower manufacturers, designers, materials scientists and engineers to achieve their objectives through simulation-driven innovation rather than physical trial and error.
July 5, 2017	Computational Engineering International, Inc. (CEI Inc.)	CEI Inc., the developer of EnSight, aids engineers and scientists in their ability to analyze, visualize and communicate large simulation data sets in clear, higher-resolution outputs.
March 10, 2017	CLK Design Automation (CLK-DA)	CLK-DA offers fast transistor simulation technology that complements our semiconductor product portfolio.

The operating results of each acquisition have been included in our consolidated financial statements since each respective date of acquisition. The effects of the business combinations were not material to our consolidated results of operations individually or in the aggregate.

5. Other Receivables and Current Assets and Other Accrued Expenses and Liabilities

Our other receivables and current assets, and other accrued expenses and liabilities, comprise the following balances:

<i>(in thousands)</i>	December 31,	
	2019	2018
Receivables related to unrecognized revenue	\$ 177,679	\$ 167,144
Income taxes receivable, including overpayments and refunds	26,672	13,709
Prepaid expenses and other current assets	45,268	35,260
Total other receivables and current assets	<u>\$ 249,619</u>	<u>\$ 216,113</u>
Consumption, sales and VAT tax liabilities	\$ 36,398	\$ 24,192
Accrued expenses and other current liabilities	106,549	75,367
Total other accrued expenses and liabilities	<u>\$ 142,947</u>	<u>\$ 99,559</u>

Receivables related to unrecognized revenue represent the current portion of billings made for customer contracts that have not yet been recognized as revenue.

6. Property and Equipment

Property and equipment consists of the following:

<i>(in thousands)</i>	Estimated Useful Lives	December 31,	
		2019	2018
Equipment	1-15 years	\$ 105,428	\$ 92,409
Computer software	1-5 years	33,878	35,053
Buildings and improvements	5-40 years	38,095	27,352
Leasehold improvements	1-17 years	19,876	15,782
Furniture	1-13 years	12,766	10,846
Land		2,696	1,759
Property and equipment, gross		212,739	183,201
Less: Accumulated depreciation		(129,103)	(121,546)
Property and equipment, net		\$ 83,636	\$ 61,655

Depreciation expense related to property and equipment was \$23.6 million, \$18.4 million and \$17.9 million for the years ended December 31, 2019, 2018 and 2017, respectively.

7. Goodwill and Intangible Assets

Goodwill represents the excess of the fair value of consideration transferred over the fair value of net identifiable assets acquired. Identifiable intangible assets acquired in business combinations are recorded based on their fair values on the date of acquisition.

During the first quarter of 2019, we completed the annual impairment test for goodwill and the indefinite-lived intangible asset and determined that these assets had not been impaired as of the test date, January 1, 2019. No other events or circumstances changed during the year ended December 31, 2019 that would indicate that the fair values of our reporting unit and indefinite-lived intangible asset are below their carrying values.

Intangible assets are classified as follows:

<i>(in thousands)</i>	December 31, 2019		December 31, 2018	
	Gross Carrying Amount	Accumulated Amortization	Gross Carrying Amount	Accumulated Amortization
Finite-lived intangible assets:				
Developed software and core technologies	\$ 635,063	\$ (332,622)	\$ 410,680	\$ (314,730)
Customer lists and contract backlog	269,629	(132,596)	209,031	(117,614)
Trade names	154,259	(117,379)	137,225	(113,677)
Total	\$ 1,058,951	\$ (582,597)	\$ 756,936	\$ (546,021)
Indefinite-lived intangible asset:				
Trade name	\$ 357		\$ 357	

Finite-lived intangible assets are amortized over their estimated useful lives of two years to seventeen years. Amortization expense for the intangible assets reflected above was \$36.9 million, \$40.8 million and \$49.8 million for the years ended December 31, 2019, 2018 and 2017, respectively.

As of December 31, 2019, estimated future amortization expense for the intangible assets reflected above is as follows:

<i>(in thousands)</i>	
2020	\$ 54,735
2021	53,231
2022	53,548
2023	52,474
2024	50,530
Thereafter	211,836
Total intangible assets subject to amortization, net	<u>476,354</u>
Indefinite-lived trade name	357
Other intangible assets, net	<u>\$ 476,711</u>

The changes in goodwill during the years ended December 31, 2019 and 2018 were as follows:

<i>(in thousands)</i>	2019	2018
Beginning balance - January 1	<u>\$ 1,572,455</u>	\$ 1,378,553
Acquisitions and adjustments ⁽¹⁾	842,588	204,381
Currency translation	(1,763)	(10,479)
Ending balance - December 31	<u>\$ 2,413,280</u>	<u>\$ 1,572,455</u>

⁽¹⁾ In accordance with the accounting for business combinations, we recorded adjustments to goodwill for the effect of changes in the provisional fair values of the assets acquired and liabilities assumed during the measurement period (up to one year from the acquisition date) as we obtained new information about facts and circumstances that existed as of the acquisition date that, if known, would have affected the measurement of the amounts recognized as of that date.

8. Fair Value Measurement

The valuation hierarchy for disclosure of assets and liabilities reported at fair value prioritizes the inputs for such valuations into three broad levels:

- Level 1: quoted prices (unadjusted) in active markets for identical assets or liabilities;
- Level 2: quoted prices for similar assets and liabilities in active markets or inputs that are observable for the asset or liability, either directly or indirectly through market corroboration, for substantially the full term of the financial instrument; or
- Level 3: unobservable inputs based on our own assumptions used to measure assets and liabilities at fair value.

A financial asset's or liability's classification within the hierarchy is determined based on the lowest level input that is significant to the fair value measurement.

The following tables provide the assets carried at fair value and measured on a recurring basis:

<i>(in thousands)</i>	December 31, 2019	Fair Value Measurements at Reporting Date Using:		
		Quoted Prices in Active Markets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets				
Cash equivalents	<u>\$ 322,455</u>	<u>\$ 322,455</u>	<u>\$ —</u>	<u>\$ —</u>
Short-term investments	<u>\$ 288</u>	<u>\$ —</u>	<u>\$ 288</u>	<u>\$ —</u>
Deferred compensation plan investments	<u>\$ 1,110</u>	<u>\$ 1,110</u>	<u>\$ —</u>	<u>\$ —</u>

<i>(in thousands)</i>	December 31, 2018	Fair Value Measurements at Reporting Date Using:		
		Quoted Prices in Active Markets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets				
Cash equivalents	\$ 446,055	\$ 446,055	\$ —	\$ —
Short-term investments	\$ 225	\$ —	\$ 225	\$ —
Deferred compensation plan investments	\$ 1,646	\$ 1,646	\$ —	\$ —

The cash equivalents in the preceding tables represent money market funds, valued at net asset value, with carrying values which approximate their fair values because of their short-term nature.

The short-term investments in the preceding tables represent deposits held by certain foreign subsidiaries. The deposits have fixed interest rates with original maturities ranging from three months to one year.

The deferred compensation plan investments in the preceding tables represent trading securities held in a rabbi trust for the benefit of the non-employee Directors. These securities consist of mutual funds traded in an active market with quoted prices. As a result, the plan assets are classified as Level 1 in the fair value hierarchy. The plan assets are recorded within other long-term assets on our consolidated balance sheets.

9. Leases

We primarily have operating leases for office space and leased cars included in our ROU assets and lease liabilities. Our executive offices and those related to certain domestic product development, marketing, production and administration are located in a 186,000 square foot office facility in Canonsburg, Pennsylvania. The term of the lease is 183 months, which began on October 1, 2014 and expires on December 31, 2029. The lease agreement includes options to renew the contract through August 2044, an option to lease additional space in January 2025 and an option to terminate the lease in December 2025. No options are included in the lease liability as renewal is not reasonably certain. In addition, we are reasonably certain we will not terminate the lease agreement. Absent the exercise of options in the lease, our base rent (inclusive of property taxes and certain operating costs) was \$4.3 million per annum for the first five years of the lease term, \$4.5 million per annum for years six through ten and \$4.7 million per annum for years eleven through fifteen.

The components of our global lease cost reflected in the consolidated statements of income for the year ended December 31, 2019 are as follows:

<i>(in thousands)</i>	
Lease liability cost	\$ 22,507
Variable lease cost not included in the lease liability ⁽¹⁾	3,754
Total lease cost	\$ 26,261

⁽¹⁾ Variable lease cost includes common area maintenance, property taxes, utilities and fluctuations in rent due to a change in an index or rate.

For the years ended December 31, 2018 and 2017, lease cost totaled \$21.3 million and \$18.4 million, respectively.

Other information related to operating leases for the year ended December 31, 2019 is as follows:

<i>(in thousands)</i>	
Cash paid for amounts included in the measurement of the lease liability:	
Operating cash flows from operating leases	\$ (20,031)
Right-of-use assets obtained in exchange for new operating lease liabilities	\$ 35,191

As of December 31, 2019, the weighted-average remaining lease term of operating leases was 7.7 years, and the weighted-average discount rate of operating leases was 3.7%.

The maturity schedule of the operating lease liabilities as of December 31, 2019 is as follows:

<i>(in thousands)</i>	
2020	\$ 21,617
2021	19,439
2022	16,616
2023	12,513
2024	12,421
Thereafter	46,159
Total future lease payments	<u>128,765</u>
Less: Present value adjustment	(18,838)
Present value of future lease payments ⁽¹⁾	<u>\$ 109,927</u>

⁽¹⁾Includes the current portion of operating lease liabilities of \$18.2 million, which is reflected in other accrued expenses and liabilities in the consolidated balance sheets.

As of December 31, 2019, we had operating office leases that have not yet commenced with combined lease obligations of \$16.3 million. The leases commence in 2020 and have a weighted-average lease term of 7.2 years.

The future minimum lease payments under ASC 840, including termination fees, under noncancellable operating leases for office space in effect at December 31, 2018 were as follows:

<i>(in thousands)</i>	
2019	\$ 16,354
2020	12,469
2021	10,177
2022	8,523
2023	6,809
Thereafter	14,267
Total	<u>\$ 68,599</u>

10. Debt

In February 2019, we entered into a credit agreement for a \$500.0 million unsecured revolving credit facility, which includes a \$50.0 million sublimit for the issuance of letters of credit, with Bank of America, N.A. as the Administrative Agent. The revolving credit facility becomes payable in full on February 22, 2024 and is available for general corporate purposes, including, among others, to finance acquisitions and capital expenditures.

In connection with the acquisition of LST, we amended our existing credit agreement (amended credit agreement). The amendment provides for a new \$500.0 million unsecured term loan facility to finance the acquisition. The term loan was funded on November 1, 2019 and matures on November 1, 2024. Principal on the term loan will be payable on the last business day of each fiscal quarter commencing with the ninth full fiscal quarter after the funding date at a rate of 1.25% per quarter, increasing to 2.50% per quarter after the next four fiscal quarters.

Borrowings under the amended credit agreement will accrue interest at the Eurodollar rate plus an applicable margin or at the base rate, at our election. For the quarter ended December 31, 2019, we elected to apply the Eurodollar rate. The base rate is the applicable margin plus the highest of (i) the federal funds rate plus 0.500%, (ii) the Bank of America prime rate and (iii) the Eurodollar rate plus 1.000%. The applicable margin for these borrowings is a percentage per annum based on the lower of (1) a pricing level determined by our then-current consolidated leverage ratio and (2) a pricing level determined by our debt ratings (if such debt ratings exist). This results in a margin ranging from 1.125% to 1.750% and 0.125% to 0.750% for the Eurodollar rate and base rate, respectively. The interest rate in effect as of December 31, 2019 was 2.964%.

The amended credit agreement contains language in the event the Eurodollar rate is not available due to LIBOR changes. If this occurs, the base rate will be used for borrowings. However, we may work with the Administrative Agent to amend the agreement to replace the Eurodollar rate with (i) one or more rates based on the Secured Overnight Financing Rate (SOFR); or (ii) another alternative benchmark rate, subject to the lenders' approval.

The amended credit agreement contains customary representations and warranties, affirmative and negative covenants and events of default. The amended credit agreement also contains a financial covenant requiring us to maintain a consolidated leverage ratio of indebtedness to earnings before interest, taxes, depreciation and amortization not exceeding 3.50 to 1.00 as of the end of any fiscal quarter (for the four-quarter period ending on such date) with an opportunity for a temporary increase in such consolidated leverage ratio to 4.00 to 1.00 upon the consummation of certain qualified acquisitions for which the aggregate consideration is at least \$250.0 million.

As of December 31, 2019, there were no outstanding borrowings under the unsecured revolving credit agreement, and the carrying value of the term loan was \$498.5 million, which is net of \$1.5 million of unamortized debt issuance costs. We were in compliance with all covenants.

As of December 31, 2019, scheduled maturities of total debt for each of the five succeeding fiscal years is as follows:

<i>(in thousands)</i>	
2020 ⁽¹⁾	\$ —
2021	—
2022	25,000
2023	50,000
2024	425,000
Total	<u>\$ 500,000</u>

⁽¹⁾We repaid \$75.0 million of the unsecured term loan in January 2020 prior to its scheduled maturity date. As such, the payment is reflected as current on our consolidated balance sheet but not in the table above.

11. Income Taxes

Income before income taxes included the following components:

<i>(in thousands)</i>	Year Ended December 31,		
	2019	2018	2017
Domestic	\$ 448,271	\$ 455,478	\$ 344,447
Foreign	74,312	31,607	51,247
Total	<u>\$ 522,583</u>	<u>\$ 487,085</u>	<u>\$ 395,694</u>

The provision for income taxes was composed of the following:

<i>(in thousands)</i>	Year Ended December 31,		
	2019	2018	2017
Current:			
Federal	\$ 44,824	\$ 58,138	\$ 112,414
State	9,554	12,888	7,879
Foreign	31,421	30,359	18,843
Deferred:			
Federal	(8,833)	(20,764)	(7,387)
State	(965)	(2,901)	(584)
Foreign	(4,713)	(10,010)	5,278
Total	<u>\$ 71,288</u>	<u>\$ 67,710</u>	<u>\$ 136,443</u>

The reconciliation of the U.S. federal statutory tax rate to the consolidated effective tax rate was as follows:

	Year Ended December 31,		
	2019	2018	2017
Federal statutory tax rate	21.0%	21.0%	35.0%
State income taxes, net of federal benefit	1.5	1.5	1.1
Foreign rate differential	0.8	0.8	0.1
Uncertain tax positions	(0.2)	0.5	0.3
U.S. tax reform enactment	(0.4)	0.2	4.5
Valuation allowance release	(1.3)	—	—
Domestic production activity benefit	—	—	(2.6)
Benefit from entity structuring activities	—	(1.4)	—
Research and development credits	(2.2)	(2.3)	(1.4)
Stock-based compensation	(3.1)	(3.3)	(3.1)
Foreign-derived intangible income deduction	(3.8)	(3.9)	—
Other	1.3	0.8	0.6
	<u>13.6%</u>	<u>13.9%</u>	<u>34.5%</u>

On December 22, 2017, the U.S. government enacted comprehensive tax legislation commonly referred to as the Tax Cuts and Jobs Act (Tax Reform). Tax Reform made broad and complex changes to the U.S. tax code, including, but not limited to, (1) reducing the U.S. federal corporate tax rate from 35 percent to 21 percent; (2) requiring companies to pay a one-time federal income tax on certain unrepatriated earnings of foreign subsidiaries (transition tax); (3) generally eliminating U.S. federal income taxes on dividends from foreign subsidiaries; (4) creating a new provision designed to tax global intangible low-taxed income (GILTI) which allows for the possibility of using foreign tax credits (FTCs) and a deduction of up to 50 percent to offset the income tax liability (subject to some limitations); (5) repealing the domestic production activity deduction; (6) creating the foreign-derived intangible income deduction; (7) creating the base erosion anti-abuse tax, a new minimum tax; (8) allowing for full expensing of qualified property through bonus depreciation; and (9) creating limitations on the deductibility of certain executive compensation.

The SEC staff issued Staff Accounting Bulletin (SAB) 118, which provides guidance on accounting for the tax effects of Tax Reform. SAB 118 provided a measurement period that was limited to one year from enactment for companies to complete the accounting under ASC 740, *Income Taxes*. In accordance with SAB 118, throughout the measurement period, a company must reflect the income tax effects of those aspects of Tax Reform for which the accounting under ASC 740 was complete in the financial statements. To the extent that a company's accounting for certain income tax effects of Tax Reform was incomplete, but a reasonable estimate was able to be made, the company must record a provisional estimate in the financial statements. If a company could not determine a provisional estimate to be included in the financial statements, it should continue to apply ASC 740 on the basis of the tax laws that were in effect immediately before the enactment of Tax Reform.

As further discussed below, we finalized our provisional Tax Reform calculations as of the end of the measurement period, based on guidance and information available as of the reporting date. The U.S. government has not yet issued final guidance related to a portion of the new rules enacted as part of Tax Reform. Subsequent adjustments, if any, will be recorded in the period in which guidance is finalized.

Our accounting for the impact of the reduction in the U.S. federal corporate tax rate on our deferred tax assets and liabilities is complete. Tax Reform reduced the corporate tax rate to 21 percent, effective January 1, 2018. Consequently, we recorded a net adjustment to deferred income tax expense of \$1.9 million for the year ended December 31, 2017 to revalue our deferred tax assets and liabilities. No further adjustments were recorded for the years ended December 31, 2019 and 2018.

Our accounting for the transition tax is complete. Reasonable estimates of certain effects were calculated and a provisional adjustment of \$16.0 million was recorded in the December 31, 2017 financial statements. To determine the amount of the transition tax, we determined, in addition to other factors, the amount of post-1986 earnings and profits (E&P) of the relevant subsidiaries, as well as the amount of non-U.S. income taxes paid on such earnings. Based on revised E&P calculations updated during the measurement period, we recognized an additional measurement-period adjustment for the year ended December 31, 2018 of \$0.9 million to the transition tax obligation and a corresponding adjustment to tax expense. In February 2019, the U.S. government published final regulations relating to transition tax. In accordance with the final regulations, we recognized a post-measurement period reduction for the year ended December 31, 2019 of \$1.8 million to the transition tax obligation and a corresponding adjustment to tax expense, resulting in a final transition tax obligation of \$15.1 million. We have elected to pay this liability over eight years; however, in accordance with IRS issued guidance, tax overpayments from the year ended

December 31, 2017 are required to be applied to the transition tax obligation. Based on this guidance, the entire balance of the obligation has been paid as of December 31, 2019.

Our accounting for the indefinite reinvestment assertion is complete. In general, it is our intention to permanently reinvest all earnings in excess of previously taxed amounts. As part of Tax Reform, substantially all of the previous earnings of our non-U.S. subsidiaries were taxed through the transition tax and current earnings are taxed as part of GILTI tax expense. These taxes increased our previously taxed earnings and allow for the repatriation of the majority of our foreign earnings without any residual U.S. federal tax. While we believe that the financial reporting bases may be greater than the tax bases of investments in foreign subsidiaries for any earnings in excess of previously taxed amounts, such amounts are considered permanently reinvested. The cumulative temporary difference related to such permanently reinvested earnings is approximately \$32.8 million and we would anticipate the tax effect on those earnings to be immaterial as a result of Tax Reform. During the year ended December 31, 2018, we repatriated \$144.3 million of foreign cash. We did not make any adjustments related to our indefinite reinvestment assertion during the years ended December 31, 2019 and 2018.

Our accounting policy choice for GILTI is complete. Under U.S. GAAP, we are allowed to make an accounting policy choice of either (1) treating taxes due on future U.S. inclusions in taxable income related to GILTI as a current-period expense when incurred (the period cost method) or (2) factoring such amounts into the measurement of our deferred taxes (the deferred method). We selected the period cost method and recorded GILTI tax expense of \$0.6 million and \$0.4 million in the financial statements for the years ended December 31, 2019 and 2018, respectively.

The components of deferred tax assets and liabilities are as follows:

<i>(in thousands)</i>	December 31,	
	2019	2018
Deferred tax assets:		
Net operating loss carryforwards	\$ 35,044	\$ 39,290
Operating lease liabilities	26,628	—
Stock-based compensation	24,254	20,464
Uncertain tax positions	19,227	17,823
Employee benefits	9,392	15,048
Research and development credits	5,865	5,951
Other	6,309	4,121
Valuation allowance	(17,524)	(21,676)
Total deferred tax assets	109,195	81,021
Deferred tax liabilities:		
Other intangible assets	(99,193)	(38,787)
Operating lease right-of-use assets	(25,648)	—
Accounting method change	(21,396)	(31,626)
Deferred revenue	(13,744)	(12,021)
Property and equipment	(3,780)	(2,034)
Total deferred tax liabilities	(163,761)	(84,468)
Net deferred tax liabilities	\$ (54,566)	\$ (3,447)

The valuation allowance decreased by \$4.2 million for the year ended December 31, 2019. Due to an enacted law change in a foreign jurisdiction during the year ended December 31, 2019, certain expenses will become nondeductible for tax purposes in 2020, resulting in the ability to utilize net operating losses in a jurisdiction where we previously determined utilization was remote. Considering all positive and negative evidence, we determined significant positive evidence exists to release \$6.7 million of valuation allowance previously established. This decrease in the valuation allowance is offset by other increases in unrealizable tax assets. As of each reporting date, management considers new evidence, both positive and negative, that could affect the future realization of deferred tax assets. If management determines it is more likely than not that an asset, or a portion of an asset, will not be realized, a valuation allowance is recorded.

As of December 31, 2019, we had federal net operating loss carryforwards of \$4.2 million. These losses expire between 2025 - 2037, and are subject to limitations on their utilization. Deferred tax assets of \$0.3 million have been recorded for state operating loss carryforwards. These losses expire between 2030 - 2038, and are subject to limitations on their utilization. We had total foreign net operating loss carryforwards of \$142.0 million, of which \$113.2 million are not currently subject to expiration dates. The remainder, \$28.8 million, expires between 2024 - 2036. We had tax credit carryforwards of \$4.1 million, of which \$1.2 million are subject to limitations on their utilization. Approximately \$0.6 million of these tax credit

carryforwards are not currently subject to expiration dates. The remainder, \$3.5 million, expires in various years between 2020 - 2039.

The following is a reconciliation of the total amounts of unrecognized tax benefits:

<i>(in thousands)</i>	Year Ended December 31,		
	2019	2018	2017
Unrecognized tax benefit as of January 1	\$ 22,827	\$ 19,657	\$ 15,209
Gross increases—acquisitions	26,914	—	—
Gross increases—tax positions in prior period	207	1,229	905
Gross decreases—tax positions in prior period	(1,743)	(376)	(765)
Gross increases—tax positions in current period	3,563	4,014	3,757
Reductions due to a lapse of the applicable statute of limitations	(2,230)	(994)	(847)
Changes due to currency fluctuation	(453)	(703)	1,414
Settlements	—	—	(16)
Unrecognized tax benefit as of December 31	\$ 49,085	\$ 22,827	\$ 19,657

We believe that it is reasonably possible that approximately \$8.3 million of uncertain tax positions included in the table above may be resolved within the next twelve months as a result of settlement with a taxing authority or a lapse of the statute of limitations. If the unrecognized tax benefit as of December 31, 2019 were to be recognized, a benefit of \$47.3 million would impact the effective tax rate.

We recognize interest and penalties related to income taxes as income tax expense. During the years ended December 31, 2019, 2018 and 2017, we recorded penalty expense of \$0.5 million, \$0.8 million and \$1.1 million, respectively. We recorded interest expense of less than \$0.1 million, interest income of \$0.1 million and interest expense of \$0.4 million for the years ended December 31, 2019, 2018 and 2017, respectively. As of December 31, 2019, we accrued a liability for penalties of \$11.7 million and interest of \$6.6 million. As of December 31, 2018, we accrued a liability for penalties of \$4.7 million and interest of \$4.0 million.

We are subject to taxation in the U.S. and various states and foreign jurisdictions. In the U.S., our only major tax jurisdiction, the 2016 - 2019 tax years are open to examination by the Internal Revenue Service.

12. Pension and Profit-Sharing Plans

We have a 401(k)/profit-sharing plan for all qualifying domestic employees that permits participants to defer a portion of their pay pursuant to Section 401(k) of the Internal Revenue Code. We make matching contributions on behalf of each eligible participant in an amount equal to 100% of the first 3% and an additional 25% of the next 5%, for a maximum total of 4.25% of the employee's compensation. We may make a discretionary contribution based on the participant's eligible compensation, provided the employee is employed at the end of the year and has worked at least 1,000 hours. We also maintain and contribute to various defined contribution and defined benefit pension arrangements for our international employees. We meet the minimum statutory funding requirements for our foreign plans. As of December 31, 2019, the total unfunded portion of the defined benefit obligations is \$11.2 million.

Expenses related to our retirement programs were \$16.3 million in 2019, \$12.4 million in 2018 and \$10.1 million in 2017.

13. Non-Compete and Employment Agreements

Our employees have signed agreements under which they have agreed not to disclose trade secrets or confidential information that, where legally permitted, restrict engagement in or connection with any business that is competitive with us anywhere in the world while employed by us (and, in some cases, for specified periods thereafter in relevant geographic areas), and that any products or technology created by them during their term of employment are our property. In addition, we require all channel partners to enter into agreements not to disclose our trade secrets and other proprietary information.

We have an employment agreement with our Chief Executive Officer. This agreement provides for, among other things, in the case of termination by us other than for Cause (as defined therein) or by the Chief Executive Officer for Good Reason (as defined therein) and subject to his execution and delivery of a release of claims against us, he will receive minimum severance payments equal to the sum of two times his base salary and target bonus to be paid out over two years from the date of

termination and up to two years of COBRA payments for health care coverage after termination. During his employment with us and for two years thereafter, following termination of employment under certain circumstances described in the contract, he will be subject to non-competition and non-solicitation obligations.

We also have employment agreements with several other employees, primarily in foreign jurisdictions. The terms of these employment agreements generally include annual compensation and non-compete clauses.

14. Stock-Based Compensation

We have an equity incentive plan - the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan (Stock Plan). The Stock Plan, as amended, authorizes the grant of approximately 39.8 million shares of our common stock in the form of: (i) incentive stock options (ISOs), (ii) nonqualified stock options, (iii) common stock with or without vesting or other restrictions, (iv) common stock upon the attainment of specified performance goals, (v) restricted stock awards, (vi) the right to receive cash dividends with the holders of the common stock as if the recipient held a specified number of shares of the common stock, (vii) deferred stock awards, (viii) restricted stock unit awards, (ix) stock appreciation rights and (x) cash-based awards.

The Stock Plan provides that: (i) the exercise price of any stock option must be no less than the fair value of the stock at the date of grant and (ii) the exercise price of an ISO held by an optionee who possesses more than 10% of the total combined voting power of all classes of stock must be no less than 110% of the fair market value of the stock at the time of grant. The Compensation Committee of the Board of Directors has the authority to set expiration dates that are no later than ten years from the date of grant (or five years for an optionee who meets the 10% criterion), payment terms, and other provisions for each grant. Shares associated with unexercised options or reacquired shares of common stock (except those shares withheld as a result of tax withholding, shares used to pay an option exercise price or pursuant to a net issuance) become available again for option grants and common stock-related awards under the Stock Plan.

The Compensation Committee of the Board of Directors may, at its sole discretion, accelerate the date or dates on which an award granted under the Stock Plan may vest or extend, in the case of a stock option, the exercise period up to the expiration date of the option, subject to the terms and conditions of the Stock Plan. Upon termination of service of a participant due to the participant's death or disability, the vesting of restricted stock units held by the participant accelerates (in case of performance-based vesting, subject to the attainment of the performance requirement).

In the event of a "sale event," defined in the Stock Plan as a "Transaction," all outstanding awards will be assumed or continued by the successor entity, with appropriate adjustment in the awards to reflect the transaction. In such event, except as the Compensation Committee may otherwise specify with respect to particular awards in the award agreements, if the service relationship of the holder of an award is terminated without cause on or within 18 months after the sale event, then all awards held by such holder will become fully vested and exercisable at that time. If there is a sale event in which the successor entity refuses to assume or continue outstanding awards, then subject to the consummation of the sale event, all awards with time-based vesting conditions will become fully vested and exercisable at the effective time of the sale event and all awards with performance-based vesting conditions may become vested at the discretion of the Compensation Committee and then all such awards will terminate at the time of the sale event. In the event of the termination of stock options or stock appreciation rights in connection with a sale event, the Compensation Committee may either make or provide for a cash payment to the holders of such awards equal to the difference between the per share transaction consideration and the exercise price of such awards or permit each holder to have at least a 15-day period to exercise such awards prior to their termination.

We currently issue shares related to exercised stock options or vested awards from our existing pool of treasury shares and have no specific policy to repurchase treasury shares as stock options are exercised or as awards vest. If the treasury pool is depleted, we will issue new shares.

Total stock-based compensation expense recognized for the years ended December 31, 2019, 2018 and 2017 is as follows:

<i>(in thousands, except per share amounts)</i>	Year Ended December 31,		
	2019	2018	2017
Cost of sales:			
Software licenses	\$ —	\$ —	\$ 969
Maintenance and service	8,494	5,224	2,533
Operating expenses:			
Selling, general and administrative	60,639	47,099	30,817
Research and development	47,057	31,023	18,835
Stock-based compensation expense before taxes	116,190	83,346	53,154
Related income tax benefits	(47,454)	(34,518)	(20,503)
Stock-based compensation expense, net of taxes	\$ 68,736	\$ 48,828	\$ 32,651
Net impact on earnings per share:			
Basic earnings per share	\$ (0.82)	\$ (0.58)	\$ (0.38)
Diluted earnings per share	\$ (0.80)	\$ (0.57)	\$ (0.38)

Stock Options

Prior to 2017, we granted stock option awards. The value of each stock option award was estimated on the date of grant, or date of acquisition for options issued in a business combination, using the Black-Scholes option pricing model (Black-Scholes model). The determination of the fair value of stock-based payment awards using an option pricing model was affected by our stock price as well as assumptions regarding a number of complex and subjective variables. These variables included our stock volatility during the preceding six years, actual and projected employee stock option exercise behaviors, interest rate assumptions using the five-year U.S. Treasury Note yield on date of grant or acquisition date, and expected dividends. The stock-based compensation expense for options is recorded ratably over the requisite service period.

Forfeitures of awards are accounted for as they occur.

As of December 31, 2019, total unrecognized estimated compensation cost related to unvested stock options granted prior to that date was \$1.0 million, which is expected to be recognized over a weighted average period of less than 1.0 year.

Information regarding stock option transactions is summarized below:

<i>(options in thousands)</i>	Year Ended December 31,					
	2019		2018		2017	
	Options	Weighted-Average Exercise Price	Options	Weighted-Average Exercise Price	Options	Weighted-Average Exercise Price
Outstanding, beginning of year	1,484	\$ 62.80	2,170	\$ 59.17	3,136	\$ 56.37
Granted	—	\$ —	—	\$ —	—	\$ —
Exercised	(495)	\$ 53.53	(679)	\$ 50.92	(956)	\$ 49.78
Forfeited	(5)	\$ 64.21	(7)	\$ 86.28	(10)	\$ 80.92
Outstanding, end of year	984	\$ 67.49	1,484	\$ 62.80	2,170	\$ 59.17
Vested and Exercisable, end of year	924	\$ 65.71	1,347	\$ 59.69	1,930	\$ 55.11
Nonvested	60	\$ 94.77	137	\$ 93.44	240	\$ 91.71

	2019	2018	2017
Weighted Average Remaining Contractual Term (in years)			
Outstanding	3.18	3.55	4.10
Vested and Exercisable	2.95	3.14	3.57
Nonvested	6.71	7.60	8.30
Aggregate Intrinsic Value (in thousands)			
Exercised	\$ 72,098	\$ 78,648	\$ 58,472
Outstanding	\$ 186,926	\$ 118,908	\$ 191,895
Vested and Exercisable	\$ 177,111	\$ 112,133	\$ 178,456
Nonvested	\$ 9,815	\$ 6,775	\$ 13,439
Compensation Expense - Stock Options (in thousands)	\$ 1,709	\$ 2,006	\$ 2,948

Historical and future expected forfeitures have not been significant and, as a result, the outstanding option amounts reflected in the tables above approximate the options expected to vest.

Information regarding stock options outstanding as of December 31, 2019 is summarized below:

<i>(options in thousands)</i>	Options Outstanding			Options Exercisable			Options Unvested		
	Options	Weighted-Average Remaining Contractual Life (years)	Weighted-Average Exercise Price	Options	Weighted-Average Remaining Contractual Life (years)	Weighted-Average Exercise Price	Options	Weighted-Average Remaining Contractual Life (years)	Weighted-Average Exercise Price
Range of Exercise Prices									
\$11.99 - \$48.97	181	1.01	\$ 43.29	181	1.01	\$ 43.29	—	0.00	\$ —
\$58.67	267	1.87	\$ 58.67	267	1.87	\$ 58.67	—	0.00	\$ —
\$67.44	280	2.87	\$ 67.44	280	2.87	\$ 67.44	—	0.00	\$ —
\$76.31 - \$95.09	256	6.44	\$ 93.89	196	6.36	\$ 93.62	60	6.71	\$ 94.77

Restricted Stock Units

Under the terms of the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan, we issue various restricted stock unit awards. The following table summarizes the types of awards and vesting conditions:

Award	Vesting Period	Vesting Condition
Restricted stock units with a market and service condition	Three years	Our performance measured by total stockholder return relative to the Nasdaq Composite Index for the measurement period and subject to continued employment through the vesting period.
Restricted stock units with an operating performance and service condition	Three years	Operating performance metrics as defined at the beginning of the performance cycle.
Restricted stock units with a service condition only	Three or four years	Continued employment through the yearly vesting period.

The fair values of restricted stock units (RSUs) with a market condition were estimated using a Monte Carlo simulation model and are recognized over the vesting period. The determination of the fair values of the awards was affected by the grant date and several variables, each of which has been identified in the chart below:

Assumptions used in Monte Carlo lattice pricing model	Year Ended December 31,		
	2019	2018	2017
Risk-free interest rate	2.5%	2.4%	1.5%
Expected dividend yield	—%	—%	—%
Expected volatility—Ansys stock price	23%	21%	19%
Expected volatility—Nasdaq Composite Index	16%	15%	15%
Expected term	2.8 years	2.8 years	2.8 years
Correlation factor	0.71	0.65	0.70
Weighted average fair value per share	\$238.99	\$191.76	\$120.94

The fair value of RSUs with operating performance metrics is based on the fair market value of our stock on the date of the grant and is recognized from the grant date through the conclusion of the measurement period associated with each operating performance metric based on management's estimates concerning the probability of vesting.

The fair value of RSUs with only a service condition is based on the fair market value of our stock on the date of the grant and is recognized over the vesting period.

Total compensation expense for employee RSU awards recorded for the years ended December 31, 2019, 2018 and 2017 was \$109.9 million, \$77.4 million and \$46.3 million, respectively.

Information regarding all employee RSU transactions is summarized below:

(RSUs in thousands)	Year Ended December 31,					
	2019		2018		2017	
	RSUs	Weighted-Average Grant Date Fair Value	RSUs	Weighted-Average Grant Date Fair Value	RSUs	Weighted-Average Grant Date Fair Value
Nonvested, beginning of year	1,522	\$ 129.96	1,361	\$ 100.66	906	\$ 86.45
Granted ⁽¹⁾	843	\$ 192.37	681	\$ 163.67	866	\$ 109.67
Performance adjustment ⁽²⁾	74	\$ 167.87	76	\$ 151.52	35	\$ 98.29
Vested	(704)	\$ 125.84	(524)	\$ 101.38	(341)	\$ 88.58
Forfeited	(117)	\$ 140.43	(72)	\$ 125.29	(105)	\$ 90.80
Nonvested, end of year	1,618	\$ 165.26	1,522	\$ 129.96	1,361	\$ 100.66

⁽¹⁾ Includes all RSUs granted during the year. RSUs with operating performance conditions are issued annually and have one or three performance cycles. Performance conditions are assigned at the beginning of each performance cycle and are reflected as grants at target at that time.

⁽²⁾ RSUs with a market or performance condition are granted at target and vest based on achievement of the market or operating performance and service conditions. The actual number of RSUs issued may be more or less than the target RSUs depending on the achievement of the market or operating performance conditions.

Board of Directors

During and prior to 2015, we granted deferred stock awards to non-employee Directors, which are rights to receive shares of common stock upon termination of service as a Director. Associated with these awards, we established a non-qualified 409(a) deferred compensation plan with assets held under a rabbi trust to provide Directors an opportunity to diversify their vested awards. During open trading windows and at their elective option, the Directors may convert their Ansys shares into a variety of non-Ansys-stock investment options in order to diversify a portion of their holdings, subject to meeting ownership guidelines.

Information regarding deferred stock awards to non-employee Directors is summarized below:

	Year Ended December 31, 2019		
	Diversified	Undiversified	Total
Deferred Awards Outstanding, beginning of year	12,250	120,449	132,699
Shares Diversified	13,348	(13,348)	—
Shares Issued Upon Retirement	(20,000)	(47,020)	(67,020)
Deferred Awards Outstanding, end of year	5,598	60,081	65,679

In 2019, 2018 and 2017, we granted 11,259, 13,632 and 18,018 RSUs to non-employee Directors, respectively, which will vest in full upon the earlier of one year from the date of grant or the date of the next regular meeting of stockholders. If a non-employee Director retires prior to the vest date, the non-employee Director receives a pro-rata portion of the RSUs. The weighted-average grant date fair values per RSU were \$187.53, \$165.71 and \$123.38 for the years ended December 31, 2019, 2018 and 2017, respectively. Total compensation expense associated with the awards recorded for the years ended December 31, 2019, 2018 and 2017 was \$2.5 million, \$2.3 million and \$2.6 million, respectively.

Employee Stock Purchase Plan

Our 1996 Employee Stock Purchase Plan (the “Purchase Plan”) was adopted by the Board of Directors on April 19, 1996 and was subsequently approved by our stockholders. The stockholders approved an amendment to the Purchase Plan in May 2016 to increase the number of shares available for offerings to 1.8 million shares. The Purchase Plan is administered by the Compensation Committee. Offerings under the Purchase Plan commence on each February 1 and August 1, and have a duration of six months. An employee who owns or is deemed to own shares of stock representing in excess of 5% of the combined voting power of all classes of our stock may not participate in the Purchase Plan.

During each offering, an eligible employee may purchase shares under the Purchase Plan by authorizing payroll deductions of up to 10% of his or her cash compensation during the offering period. The maximum number of shares that may be purchased by any participating employee during any offering period is limited to 3,840 shares (as adjusted by the Compensation Committee from time to time). Unless the employee has previously withdrawn from the offering, his or her accumulated payroll deductions will be used to purchase common stock on the last business day of the period at a price equal to 90% of the fair market value of the common stock on the first or last day of the offering period, whichever is lower. Under applicable tax rules, an employee may not accrue the right to purchase more than \$25,000 of common stock, based on the grant-date fair value, in any calendar year in which the option is outstanding at any time. As of December 31, 2019, 1.6 million shares of common stock had been issued under the Purchase Plan. The total compensation expense recorded under the Purchase Plan during the years ended December 31, 2019, 2018 and 2017 was \$2.0 million, \$1.8 million and \$1.2 million, respectively.

15. Stock Repurchase Program

Under our stock repurchase program, we repurchased shares as follows:

<i>(in thousands, except per share data)</i>	Year Ended December 31,		
	2019	2018	2017
Number of shares repurchased	330	1,674	2,750
Average price paid per share	\$ 179.41	\$ 161.12	\$ 122.20
Total cost	\$ 59,116	\$ 269,801	\$ 336,042

In February 2018, our Board of Directors increased the number of shares authorized for repurchase to a total of 5.0 million shares under the stock repurchase program. As of December 31, 2019, 3.5 million shares remained available for repurchase under the program.

16. Royalty Agreements

We have entered into various renewable license agreements under which we have been granted access to the licensor's technology and the right to sell the technology in our product line. Royalties are payable to developers of the software at various rates and amounts, which generally are based upon unit sales, revenue or flat fees. Royalty fees are reported in cost of software licenses and were \$22.4 million, \$16.9 million and \$16.0 million for the years ended December 31, 2019, 2018 and 2017, respectively.

17. Geographic Information

Revenue to external customers is attributed to individual countries based upon the location of the customer. Revenue by geographic area was as follows:

<i>(in thousands)</i>	Year Ended December 31,		
	2019 (ASC 606)	2018 (ASC 606)	2017 (ASC 605)
United States	\$ 637,916	\$ 506,335	\$ 417,343
Japan	162,154	145,951	126,097
Germany	158,809	140,506	108,211
South Korea	90,082	72,724	63,011
France	68,551	67,657	53,672
China	64,725	57,567	54,415
Other EMEA	211,193	193,317	166,472
Other international	122,462	109,579	106,029
Total revenue	<u>\$ 1,515,892</u>	<u>\$ 1,293,636</u>	<u>\$ 1,095,250</u>

Property and equipment by geographic area was as follows:

<i>(in thousands)</i>	December 31,	
	2019	2018
United States	\$ 59,473	\$ 46,605
India	5,660	4,176
Germany	4,237	2,158
United Kingdom	4,194	1,238
Other EMEA	5,532	3,724
Other international	4,540	3,754
Total property and equipment, net	<u>\$ 83,636</u>	<u>\$ 61,655</u>

18. Unconditional Purchase Obligations

We have entered into various unconditional purchase obligations which primarily include royalties and software licenses and services. We expended \$24.2 million, \$22.4 million and \$14.1 million related to unconditional purchase obligations that existed as of the beginning of each year for the years ended December 31, 2019, 2018 and 2017, respectively. Future expenditures under unconditional purchase obligations in effect as of December 31, 2019 are as follows:

<i>(in thousands)</i>	
2020	\$ 37,183
2021	14,034
2022	10,689
2023	6,212
2024	3,264
Total	<u>\$ 71,382</u>

19. Restructuring

During the fourth quarter of 2016, we initiated workforce realignment activities to reallocate resources to align with our future strategic plans. We completed the workforce realignment activities as of September 30, 2017. We incurred related restructuring charges as follows:

<i>(in thousands)</i>	Gross	Net of Tax
Q4 2016	\$ 3,419	\$ 2,355
Q1 2017	9,273	6,176
Q2 2017	2,000	1,435
Q3 2017	466	331
Total restructuring charges	<u>\$ 15,158</u>	<u>\$ 10,297</u>

The restructuring charges are included in the presentation of cost of software licenses; cost of maintenance and service; research and development expense; and selling, general and administrative expense. The gross charges were fully paid as of March 31, 2018.

20. Contingencies and Commitments

We are subject to various investigations, claims and legal proceedings that arise in the ordinary course of business, including commercial disputes, labor and employment matters, tax audits, alleged infringement of intellectual property rights and other matters. In our opinion, the resolution of pending matters is not expected to have a material adverse effect on our consolidated results of operations, cash flows or financial position. However, each of these matters is subject to various uncertainties and it is possible that an unfavorable resolution of one or more of these proceedings could materially affect our results of operations, cash flows or financial position.

Our Indian subsidiary has several service tax audits pending that have resulted in formal inquiries being received on transactions through mid-2012. We could incur tax charges and related liabilities of approximately \$7.2 million. The service tax issues raised in our notices and inquiries are very similar to the case, M/s Microsoft Corporation (I) (P) Ltd. Vs. Commissioner of Service Tax, New Delhi, wherein the Delhi Customs, Excise and Service Tax Appellate Tribunal (CESTAT) passed a favorable ruling to Microsoft. The Microsoft case ruling was subsequently challenged in the Supreme Court by the Indian tax authority. We can provide no assurances on the impact that the present Microsoft case's decision will have on our cases. We are uncertain as to when these service tax matters will be concluded.

We sell software licenses and services to our customers under contractual agreements. Such agreements generally include certain provisions indemnifying the customer against claims of intellectual property infringement by third parties arising from such customer's usage of our products or services. To date, payments related to these indemnification provisions have been immaterial. For several reasons, including the lack of prior material indemnification claims, we cannot determine the maximum amount of potential future payments, if any, related to such indemnification provisions.

ANSYS, INC. AND SUBSIDIARIES
Valuation and Qualifying Accounts

<i>(in thousands)</i>	Description	Balance at Beginning of Year	Additions: Charges to Costs and Expenses	Deductions: Returns and Write-Offs	Balance at End of Year
	Year ended December 31, 2019				
	Allowance for doubtful accounts	\$ 8,000	\$ 2,928	\$ 2,228	\$ 8,700
	Year ended December 31, 2018				
	Allowance for doubtful accounts	\$ 6,800	\$ 1,577	\$ 377	\$ 8,000
	Year ended December 31, 2017				
	Allowance for doubtful accounts	\$ 5,700	\$ 1,474	\$ 374	\$ 6,800

<u>Exhibit No.</u>	<u>Exhibit</u>
3.1	Restated Certificate of Incorporation of the Company; filed herewith.
3.2	Third Amended and Restated By-laws of the Company (filed as Exhibit 3.1 to the Company's Current Report on Form 8-K, filed January 19, 2018, and incorporated herein by reference).
4.1	Description of Securities; filed herewith.
10.1	Form of Indemnification Agreement between ANSYS, Inc. and Non-Employee Directors (filed as Exhibit 10.1 to the Company's Current Report on Form 8-K, filed March 20, 2013, and incorporated herein by reference).*
10.2	Non-Employee Director Deferred Compensation Plan (filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q, filed November 7, 2019, and incorporated herein by reference).*
10.3	Executive Severance Plan, as amended and restated, dated July 29, 2014; filed herewith.*
10.4	Fourth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan (filed as Exhibit 10.1 to the Company's Current Report on Form 8-K, filed May 17, 2011, and incorporated herein by reference).*
10.5	Form of Deferred Stock Unit Agreement under the Fourth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan; filed herewith.*
10.6	Form of Employee Non-Qualified Stock Option Agreement under the Fourth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q, filed May 2, 2013, and incorporated herein by reference).*
10.7	Form of Restricted Stock Unit Agreement under the Fourth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan (filed as Exhibit 10.39 to the Company's Annual Report on Form 10-K, filed February 27, 2014, and incorporated herein by reference).*
10.8	Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan (filed as Appendix 1 to the registrant's Definitive Proxy Statement on Schedule 14A filed with the SEC on March 31, 2016 and incorporated herein by reference).*
10.9	Form of Non-Qualified Stock Option Agreement under the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan (filed as Exhibit 10.36 to the Company's Annual Report on Form 10-K, filed February 23, 2017, and incorporated herein by reference).*
10.10	2017 Form of Restricted Stock Unit Agreement under the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan (filed as Exhibit 10.35 to the Company's Annual Report on Form 10-K, filed February 23, 2017, and incorporated herein by reference).*
10.11	2018 Form of Restricted Stock Unit Agreement under the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan; filed herewith.*
10.12	2019 Form of Restricted Stock Unit Agreement under the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan; filed herewith.*
10.13	Form of Restricted Stock Unit Award Agreement (Non-Employee Directors) under the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan; filed herewith.*
10.14	2018 Form of Award Notice (Operating Margin) under the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan; filed herewith.*
10.15	2018 Form of Award Notice (Total Shareholder Return) under the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan; filed herewith.*
10.16	2019 Form of Award Notice (Annual Contract Value) under the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan; filed herewith.*
10.17	2019 Form of Award Notice (Total Shareholder Return) under the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan; filed herewith.*
10.18	2019 Form of Special Performance Stock Unit Agreement under the Fifth Amended and Restated ANSYS, Inc. 1996 Stock Option and Grant Plan; filed herewith.*
10.19	Employment Agreement between ANSYS, Inc. and Ajei S. Gopal, dated August 29, 2016 (filed as Exhibit 10.1 to the Company's Current Report on Form 8-K, filed August 29, 2016, and incorporated herein by reference).*
10.20	Form of Non-Qualified Stock Option Agreement with Ajei S. Gopal (filed as Exhibit 10.3 to the Company's Current Report on Form 8-K, filed August 29, 2016, and incorporated herein by reference).*

10.21	Lease by and between ANSYS, Inc. and Quattro Investment Group, L.P., dated as of September 14, 2012 (filed as Exhibit 10.1 to the Company's Current Report on Form 8-K, filed September 18, 2012, and incorporated herein by reference).
10.22	Credit Agreement, dated as of February 22, 2019, among ANSYS, Inc. as borrower, Bank of America, N.A. as Administrative Agent and the banks listed therein (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q, filed May 2, 2019, and incorporated herein by reference).
10.23	First Amendment to Credit Agreement dated October 16, 2019, by and among ANSYS, Inc., the lenders party thereto and Bank of America, N.A. (filed as Exhibit 10.1 to the Company's Current Report on Form 8-K, filed October 21, 2019, and incorporated herein by reference).
21.1	Subsidiaries of the Registrant; filed herewith.
23.1	Consent of Deloitte & Touche LLP, independent registered public accounting firm.
24.1	Powers of Attorney. Contained on the Signatures page of the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2019 and incorporated herein by reference.
31.1	Certification of Chief Executive Officer pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
31.2	Certification of Chief Financial Officer pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
32.1	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
32.2	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
101.INS	Inline XBRL Instance Document (the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document)
101.SCH	Inline XBRL Taxonomy Extension Schema
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase
104	Cover Page Interactive Data File (formatted as Inline XBRL and contained in Exhibit 101)

* *Indicates management contract or compensatory plan, contract or arrangement.*

ITEM 16. FORM 10-K SUMMARY

None.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

ANSYS, Inc.

Date: February 27, 2020

By: /s/ AJEI S. GOPAL

Ajei S. Gopal
President and Chief Executive Officer
(Principal Executive Officer)

Date: February 27, 2020

By: /s/ MARIA T. SHIELDS

Maria T. Shields
Chief Financial Officer
(Principal Financial Officer and Principal Accounting Officer)

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints Ajei S. Gopal, his or her attorney-in-fact, with the power of substitution, for such person in any and all capacities, to sign any amendments to this Report on Form 10-K, and to file the same, with exhibits thereto and other documents in connection therewith, with the Securities and Exchange Commission, hereby ratifying and confirming all that said attorney-in-fact, or substitute or substitutes, may do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Exchange Act of 1934, this Annual Report has been signed below by the following persons on behalf of the Registrant and in the capacities and on the dates indicated below.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<u>/s/ AJEI S. GOPAL</u> Ajei S. Gopal	President and Chief Executive Officer (Principal Executive Officer)	February 27, 2020
<u>/s/ MARIA T. SHIELDS</u> Maria T. Shields	Chief Financial Officer (Principal Financial Officer and Principal Accounting Officer)	February 27, 2020
<u>/s/ NICOLE ANASENES</u> Nicole Anasenes	Director	February 27, 2020
<u>/s/ GLENDA M. DORCHAK</u> Glenda M. Dorchak	Director	February 27, 2020
<u>/s/ GUY E. DUBOIS</u> Guy E. Dubois	Director	February 27, 2020
<u>/s/ DR. ALEC D. GALLIMORE</u> Dr. Alec D. Gallimore	Director	February 27, 2020
<u>/s/ RONALD W. HOVSEPIAN</u> Ronald W. Hovsepian	Chairman of the Board of Directors	February 27, 2020
<u>/s/ BARBARA V. SCHERER</u> Barbara V. Scherer	Director	February 27, 2020

CHIEF EXECUTIVE OFFICER CERTIFICATION

I, Ajei S. Gopal, certify that:

1. I have reviewed this annual report on Form 10-K of ANSYS, Inc. (“Ansys”);
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of Ansys as of, and for, the periods presented in this report;
4. Ansys’ other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for Ansys and have:
 - a. Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to Ansys, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
 - b. Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
 - c. Evaluated the effectiveness of Ansys’ disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
 - d. Disclosed in this report any change in Ansys’ internal control over financial reporting that occurred during Ansys’ most recent fiscal quarter (Ansys’ fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, Ansys’ internal control over financial reporting; and
5. Ansys’ other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to Ansys’ auditors and the audit committee of Ansys’ board of directors (or persons performing the equivalent functions):
 - a. All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect Ansys’ ability to record, process, summarize and report financial information; and
 - b. Any fraud, whether or not material, that involves management or other employees who have a significant role in Ansys’ internal control over financial reporting.

Date: February 27, 2020

/s/ Ajei S. Gopal

Ajei S. Gopal

President and Chief Executive Officer

CHIEF FINANCIAL OFFICER CERTIFICATION

I, Maria T. Shields, certify that:

1. I have reviewed this annual report on Form 10-K of ANSYS, Inc. (“Ansys”);
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of Ansys as of, and for, the periods presented in this report;
4. Ansys’ other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for Ansys and have:
 - a. Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to Ansys, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
 - b. Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
 - c. Evaluated the effectiveness of Ansys’ disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
 - d. Disclosed in this report any change in Ansys’ internal control over financial reporting that occurred during Ansys’ most recent fiscal quarter (Ansys’ fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, Ansys’ internal control over financial reporting; and
5. Ansys’ other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to Ansys’ auditors and the audit committee of Ansys’ board of directors (or persons performing the equivalent functions):
 - a. All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect Ansys’ ability to record, process, summarize and report financial information; and
 - b. Any fraud, whether or not material, that involves management or other employees who have a significant role in Ansys’ internal control over financial reporting.

Date: February 27, 2020

/s/ Maria T. Shields

Maria T. Shields
Chief Financial Officer

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report of ANSYS, Inc. (the “Company”) on Form 10-K for the year ended December 31, 2019 as filed with the Securities and Exchange Commission on the date hereof (the “Report”), I, Ajei S. Gopal, President and Chief Executive Officer of the Company, certify, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that to my knowledge:

- (1) The Report fully complies with requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, and
- (2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

This certification is provided solely pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, and shall not be deemed to be part of the Report or filed for any purpose whatsoever.

/s/ Ajei S. Gopal

Ajei S. Gopal

President and Chief Executive Officer

February 27, 2020

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report of ANSYS, Inc. (the “Company”) on Form 10-K for the year ended December 31, 2019 as filed with the Securities and Exchange Commission on the date hereof (the “Report”), I, Maria T. Shields, Chief Financial Officer of the Company, certify, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that to my knowledge:

- (1) The Report fully complies with requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, and
- (2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

This certification is provided solely pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, and shall not be deemed to be part of the Report or filed for any purpose whatsoever.

/s/ Maria T. Shields

Maria T. Shields

Chief Financial Officer

February 27, 2020



[ansys.com](https://www.ansys.com)