

PART I

ITEM 1. BUSINESS

ANSYS, Inc. (Ansys, we, us, our), a 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 high-tech, aerospace and defense, automotive, energy, industrial equipment, materials and chemicals, consumer products, healthcare and construction. Headquartered south of Pittsburgh, Pennsylvania, we employed 6,200 and 5,600 people as of December 31, 2023 and 2022, respectively. We focus on the development of open and flexible solutions that enable users to analyze designs on-premises and/or via the cloud, providing a common platform for fast, efficient and cost-conscious product development, from design concept to final-stage testing, validation and deployment. We distribute our suite of simulation technologies through direct sales offices in strategic, global locations and a global network of independent resellers and distributors (collectively, channel partners). It is our intention to continue to maintain this hybrid sales and distribution model. We operate and report as one segment.

When visionary companies need to know how their world-changing ideas will perform, they close the gap between design and reality using Ansys simulation. For more than 50 years, Ansys software has enabled innovators across industries to push the boundaries of product design by using the predictive power of simulation. From sustainable transportation and advanced satellite systems to life-saving medical devices, Ansys powers innovation that drives human advancement.

Our strategy of Pervasive Insights seeks to deepen the use of simulation in our core market, to inject simulation throughout the product lifecycle and extend the accessibility to a broader set of users and use cases. Our business has three vectors of growth:

- More products. Our broad and deep multiphysics portfolio enables us to grow with customers as they use simulation to solve more complex problems across a broad set of industries.
- More users. Investments in simulation education and user experience simplification has made simulation more accessible to a broader user base.
- More computations. Larger and more complex simulations drive more computation, requiring customers to use more Ansys licenses to complete their simulations.

Through decades of investments in the academic community and enhanced user experiences, our solutions have become accessible and relevant beyond our core "engineering" end user, to reach more users upstream and downstream from our core, which is the product validation process. Our multiphysics solutions enable our customers to address increasingly complex research and development (R&D) challenges from the component through the system and mission level of analysis. Our products seamlessly enable access to high performance compute capacity to run simulations, on-premises or in the cloud, which means our customers' R&D teams are unencumbered by compute capacity limitations that can hinder R&D cycle times. Our investments in artificial intelligence capabilities across our simulation portfolio and technical support services enhance the customer experience, democratize simulation and further next-generation innovation.

The engineering software simulation market is strong and growing. The market growth is driven by customers' need for rapid, quality innovation in a cost-efficient manner, enabling faster time to market for new products and lower warranty costs. Increasing product complexity is driving sustained demand for simulations. Key industry trends fueling customers' increasing needs for simulation include:

- Electrification;
- Autonomy;
- Connectivity;
- The industrial internet of things (IIoT); and
- Sustainability, including minimizing waste and physical prototyping, and improving circularity and development time.

We have been investing and intend to continue to invest in our portfolio to broaden the range of physics and enable customers to analyze the interactions among physics at the component, system and mission level. Our strategy of Pervasive Insights is aligned with the near-term market growth opportunities and is laying the foundation for a future where simulation can be further democratized to broader classes of end-users and end-use cases. In addition, we have and will continue to partner with industry leaders to extend simulation into other ecosystems and customer R&D workflows.

Synopsys Merger Agreement

On January 15, 2024, we entered into an Agreement and Plan of Merger (the “Merger Agreement”) with Synopsys, Inc., a Delaware corporation (“Synopsys”), and ALTA Acquisition Corp., a Delaware corporation and wholly owned subsidiary of Synopsys (“Merger Sub”). The Merger Agreement provides for the merger of Merger Sub with and into Ansys, with Ansys surviving the merger as a wholly owned subsidiary of Synopsys (the “Merger”). Our Board of Directors has unanimously approved the Merger Agreement and, subject to certain exceptions set forth in the Merger Agreement, resolved to recommend that our stockholders adopt the Merger Agreement. If the Merger is consummated, our common stock will be delisted from the Nasdaq Global Select Market and deregistered under the Exchange Act.

Under the Merger Agreement, at the effective time of the Merger, each issued and outstanding share of our common stock (subject to certain exceptions set forth in the Merger Agreement) will be cancelled and converted into the right to receive (i) 0.3450 (the “Exchange Ratio”) of a share of common stock, par value \$0.01 per share, of Synopsys (the “Stock Consideration”) and (ii) \$197.00 in cash, without interest (the “Per Share Cash Amount”), subject to applicable withholding taxes. With regard to the Stock Consideration, if the aggregate number of shares of Synopsys common stock to be issued in connection with the Merger would exceed 19.9999% of the shares of Synopsys common stock issued and outstanding immediately prior to the effective time of the Merger (the “Maximum Share Number”), (a) the Exchange Ratio will be reduced to the minimum extent necessary such that the aggregate number of shares of Synopsys common stock to be issued in connection with the Merger does not exceed the Maximum Share Number and (b) the Per Share Cash Amount will be correspondingly increased to offset such adjustment.

The Merger Agreement contains customary representations, warranties and covenants made by each of Ansys, Synopsys, and Merger Sub, including, among others, covenants regarding the conduct of our and Synopsys’ businesses during the pendency of the transactions contemplated by the Merger Agreement, the making of certain public disclosures and other matters as described in the Merger Agreement. We and Synopsys have agreed to use reasonable best efforts to take all actions necessary to consummate the Merger, including cooperating to obtain the regulatory approvals necessary to complete the Merger. We have agreed not to, among other things, (a) solicit proposals relating to alternative transactions or (b) enter into discussions or negotiations or provide non-public information in connection with any proposal for an alternative transaction from a third party, subject to certain exceptions to permit our Board of Directors to comply with its fiduciary obligations. We have further agreed to cease and cause to be terminated any existing discussions or negotiations, if any, with regard to alternative transactions.

The Merger Agreement may be terminated under certain circumstances, including that either party may have the right to terminate if the Merger is not completed by January 15, 2025, which may be extended to January 15, 2026 as provided in the Merger Agreement. If the Merger Agreement is terminated, (A) Synopsys, under specified circumstances, including termination following an injunction arising in connection with certain antitrust or foreign investment laws, will be required to pay us a termination fee of \$1,500.0 million; and (B) we, under specified circumstances, including our termination of the Merger Agreement to accept and enter into a definitive agreement with respect to a Superior Proposal (as defined in the Merger Agreement) or Synopsys’ termination upon the change by our Board of Directors of its recommendation in favor of the Merger, will be required to pay Synopsys a termination fee of \$950.0 million.

The completion of the Merger is subject to customary closing conditions, including, among others, approval of the Merger under certain applicable antitrust and foreign investment regimes and the adoption of the Merger Agreement by our stockholders. We anticipate the transaction to close in the first half of 2025.

The foregoing summary of the Merger Agreement and the transactions contemplated thereby does not purport to be complete and is subject to, and qualified in its entirety by, the Merger Agreement, which was filed as Exhibit 2.1 to our Current Report on Form 8-K filed on January 16, 2024, and is incorporated herein by reference.

Ansys and any and all ANSYS, Inc. brand, product, service and feature names, logos and slogans are registered trademarks or trademarks of ANSYS, Inc. or its subsidiaries in the United States or other countries. All other brand, product, service and feature names or trademarks are the property of their respective owners.

PORTFOLIO

Our portfolio consists of the following capabilities:

Structures

Our structural analysis product suite offers simulation tools for product design and optimization designed to increase productivity, reduce physical prototyping and help 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.

Our flagship product is the Ansys Mechanical™ product, a finite element analysis software used for simulating and analyzing the behavior of mechanical and structural systems. It is commonly used for structural analysis, allowing engineers to simulate and study the response of materials and structures to various mechanical loads, including static, dynamic, vibrational and thermal loads. A key attribute is the ability to perform multiphysics simulations, where multiple physical phenomena, such as structural mechanics, heat transfer, fluid dynamics and electromagnetics, interact with each other. The software can handle nonlinear problems, including large deformations, material nonlinearity and contact interactions.

Ansys has a long history of technological innovations, including pioneering innovations such as nonlinear adaptivity and separating morphing and adaptive remeshing technology to solve the toughest structural simulation challenges. We also provide comprehensive topology optimization tools that engineers use to design structural components to meet loading requirements with reduced material and component weight. Additionally, our comprehensive and scalable additive manufacturing solutions allow customers to reduce risk and provide high quality, certifiable parts.

Our LS-DYNA® solver is a leader in explicit dynamics multiphysics simulation and is used worldwide by leaders in automotive crash, drop tests, airbag deployment and impact analysis. Innovations like multi-scale co-simulation capability for meso-scale effects allow electronics reliability simulations to predict component failure at a tiny scale when a macro scale printed circuit board drop test is analyzed.

Electronics

Our electronics product suite provides electromagnetic 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). It is also used in low-frequency applications such as electromechanical systems, automotive components, industrial electric motors and power electronics equipment.

The flagship Ansys High Frequency Structure Simulator™ (HFSS) product is used in all aspects of radio frequency and microwave design for 5G/6G communications, avionics, aerospace and defense (A&D) and biomedical applications. It is used for advanced antenna design and integration, radar systems and electromagnetic interference analysis. Innovations have enabled the electronics industry to solve some of the most challenging design problems. Advanced automatic adaptive meshing, tangential vector finite elements and commercial implementation of domain decomposition are a few of the Ansys inventions that power finite element analysis for electromagnetics. Technologies such as Mesh Fusion allow virtually unlimited size and scope of system-level electromagnetic simulation by leveraging high-performance computing (HPC) and the cloud.

Fluids

Our fluids product suite enables modeling of fluid flow and other related physical phenomena. The flagship Ansys Fluent® computational fluid dynamics (CFD) software package is used for simulating and analyzing the behavior of fluids (liquids and gases) and their interactions with solid structures. It is commonly employed in various industries to perform simulations that help engineers and researchers gain insights into fluid flow, heat transfer and chemical reactions and related phenomena. Innovations include its mixed-element unstructured solver and interactive architecture with pervasive HPC scaling. Recent additions to our fluids product suite substantially reduce simulation solve time and total power consumption using the native multi-graphics processing unit (GPU) solver available in Fluent, with results showing that four typical GPUs have greater performance than 1,000 central processing unit (CPU) cores. In Ansys 2023 R2, we extended multi-GPU support to sliding mesh, compressible flows and eddy dissipation model combustion simulations for applications such as internal combustion engines, centrifugal pumps and fans, turbochargers and compressors. Also, Ansys 2023 R2 expands to clusters that use ARM-based servers, which have the potential to reduce hardware cost and overall energy consumption.

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 and the capacity to handle an entire electronic system, including IC, package and PCB.

Ansys RedHawk-SC™ is the flagship electronic design automation (EDA) software tool, used for the analysis and sign-off of ICs, focusing on power integrity and reliability issues. It is used by semiconductor designers and engineers to simulate and optimize power delivery networks in ICs and heterogeneous 3D-ICs ensuring that they operate reliably and efficiently. The Ansys RedHawk-SC product is an industry trusted gold standard voltage drop and electromigration multiphysics sign-off solution for digital designs. Its powerful analytics quickly identify any weaknesses and allow what-if explorations to optimize power and performance. Redhawk-SC's cloud-based architecture gives it the speed and capacity to handle full-chip analysis. Sign-off accuracy is certified by all major foundries for all finFET nodes, down to 3 nanometer (nm).

Innovations include 'dynamic' power noise simulation technology, behavior simulation of power distribution networks under realistic, time-varying activity loading, and with the distributed, big-data data management capacity to handle full-chip analysis with many billions of electrical nodes. The Redhawk-SC product and other Ansys tools provide the industry's first foundry-validated hierarchical thermal analysis flow for multi-die 3D-IC designs and 5nm/3nm chips.

Optics, Virtual Reality (VR) and Photonics

Modeling light propagation and its impact is crucial for measuring product performance and human comfort, perception and safety. Ansys Optics™ software uniquely simulates a system's optical performance, evaluates the final illumination effect, and predicts and validates the impact of lighting and material variations on appearance and perceived quality all in real conditions. Using optical sensor and closed-loop, real-time simulation, our optics simulation capabilities now span the simulation of a wide range of 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 for automotive applications, enabling thousands of driving scenarios to be executed virtually.

Our photonic design and simulation tools enable customers to predict light's behavior within complex photonic structures and systems. Silicon photonics is an expanding market and our solutions provide a comprehensive set of tools for the design and analysis of integrated photonic components and systems, similar to the traditional EDA environment. The Ansys Lumerical™ product is a complete photonics simulation software solution that enables the design of photonics components, circuits, and systems. Device and system level tools work together to allow designers to model interacting optical, electrical and thermal effects. Flexible interoperability between products enables a variety of workflows that combine device multiphysics and photonic circuit simulation with third-party design automation and productivity tools. Python-based automation and flows for building and using compact models support the industry's leading foundries.

Digital Mission Engineering

Our mission-simulation, modeling, testing and analysis software for aerospace, defense and intelligence applications empowers our users to solve challenges by simulating from the chip level all the way to a customer's entire mission. Digital mission engineering products enable engineers, operators and analysts to connect modeling and simulation efforts across all phases of the engineering product life cycle. Users can model operational environments and the interrelationships of assets with accurate, dynamic, physics-based simulations to validate system designs with respect to the mission's outcome. Modeling of assets may be performed across multiple domains, including land, sea, air and space.

Our technology enables our customers to consider the entire mission engineering of a product or system. Engineered products and systems can involve thousands of components, subsystems, systems and systems of systems that must work together intricately. Our software simulates these puzzle pieces and their functional relationships to each other and, increasingly, to their environments.

3D Design

Our Discovery™ product family allows engineers 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 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.

Our Discovery product's ease of use and speed enable more engineers to benefit from simulation. Increasingly, "shifting-left" or moving simulation up front in the design process has become a critical business initiative for our customers, enabling more engineers, more analysts and more designers to get early insights into their product design. The Discovery application has become more integrated with the broader Ansys portfolio. This has manifested itself into many analysts starting in the Discovery product and then moving to more detailed analyses in our other applications.

We continue to invest in and advance the Discovery product and Discover Live™ physics technology, improving accuracy, expanding capabilities and accelerating productivity. Recent advances include the addition of electromagnetics simulation for upfront antenna design for IIoT and 5G, breakthroughs in solver numerics to support unstructured meshes that deliver both speed and accuracy across all CFD applications, and a Microsoft 365 integration for enabling data management and collaboration among designers, analysts and stakeholders using a connected digital thread. Additionally, the Discovery application has become more tightly integrated with the broader Ansys portfolio through new Ansys optiSLang™ and ModelCenter® integrations.

Platform

Our platform is the framework upon which our suite of advanced multiphysics engineering simulation technologies is built. It 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 and various domain disciplines interact in a coupled way. Our software enables engineers to simulate the interactions between structures, heat transfer, fluids, electronics, optical elements and embedded software all within a single, unified engineering simulation environment.

Today's engineered products are increasingly complex, demanding new solutions for optimal design. Products have integrated electronics and semiconductors, embedded software, wired and wireless connectivity and advanced sensors and displays. Product success requires our customers to consider the full system operation in a broad context. We have extended our platform to support scalable solutions that leverage new algorithms, additional physics, system solutions, embedded intelligence, HPC and integrated cloud. Our HPC product suite and cloud solutions enable enhanced insight into product performance and improve the productivity of the design process.

The following tools are part of our platform and add capability to the core of our offered products:

The Ansys HPC™ software suite leverages multicore computers to perform more simulations in less time. These simulations can be bigger, more complex and more accurate using HPC. Various Ansys HPC licensing options allow organizations to scale to whatever computational level of simulation is preferred, from single-user or small user group options for entry-level parallel processing up to virtually unlimited parallel capacity. Apart from parallel computing, Ansys also offers solutions for parametric computing, which enables users to explore the design parameters more fully (size, weight, shape, materials, mechanical properties, etc.) for products early in the development process.

Our cloud portfolio comprises of two marketplace offerings (Ansys Gateway powered by AWS and Ansys Access on Microsoft Azure) and a managed cloud offering (Ansys Cloud Direct™), providing customers scalable location-independent access to simulation. We continue to enhance our solvers and collaborate with HPC leaders such as NVIDIA and Advanced Micro Devices (AMD) to maximize scalability and speed. Ansys 2023 R2 included tuning of our Fluent and Mechanical GPU solvers for NVIDIA's latest architecture and for AMD's GPUs. Refinements include an electromagnetically coupled solution that provides a 7.5X speedup for IC applications in HFSS. We also added new features in Ansys HFSS that take advantage of high-performance computing to simulate complex antennas that advance 5G and 6G radio systems. Ansys Maxwell® has a new capability that leverages HPC to enable users to determine the cause of undesired noise and vibrations in PCBs.

Our Ansys Minerva™ platform is a knowledge management application that secures critical simulation data, and provides simulation process and decision support to simulation teams across geographies and functional silos. Available for both on-premises and cloud deployment, the Minerva platform delivers benefits by connecting simulation and optimization to customers' existing ecosystem of tools and processes. The Minerva platform provides integration and automation of chained data flows and design space exploration for optimal performance parameters. With the Ansys Minerva platform, customers can connect simulation for life cycle traceability and to enable collaboration and decision support.

PyAnsys™ is a collection of Python-based, open-source projects tailored specifically for engineers seeking to extend the capabilities of Ansys products. Developed as a collection of Python client libraries, PyAnsys offers engineers a comprehensive set of tools and utilities that seamlessly integrate with Ansys software, empowering them to enhance their simulations and analyses. PyAnsys provides an extensible platform-centric approach to the development and deployment of new verticalized, or use-case-specific, applications and workflows that leverage simulation.

The Ansys optiSLang product is a leading-edge answer to the challenges posed by computer-aided engineering (CAD)-based robust design optimization (RDO). Its state-of-the-art algorithms efficiently and automatically search for the most robust design configuration, eliminating the slow, manual process that used to define RDO.

The Ansys ModelCenter platform is a Model Based Systems Engineering (MBSE) software platform for managing and automating simulation processes in engineering. It enables the automation of any simulation tool and enables the creation and automation of simulation workflows. A unique capability of the ModelCenter platform is rigorous MBSE enablement by connecting with system architecture modeling tools to verify system performance throughout the product design lifecycle. The software provides a centralized environment for managing simulation inputs, outputs and results, as well as for running trade studies and optimizing system designs in the conceptual design stage. It supports integration with various Ansys simulation tools, as well as with third-party software tools.

Embedded Software

Our SCADE® 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. SCADE software supports the entire development workflow, from requirements analysis and design, through verification, implementation and deployment. SCADE solutions easily integrate with each other and the rest of our product suite, allowing for development optimization and increased communication among team members.

Materials

With our materials 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. The Ansys Granta MI™ system is a leading system for materials information management in engineering enterprises. Ansys Granta Selector™ technology 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. The CES EduPack™ product 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.

Safety Analysis

Our safety and cybersecurity threat analysis software facilitates model-based safety analysis, safety concept creation, safety management and cybersecurity assessment for safety-critical electrical, electronic and software-controlled systems. Using this software, engineers can deliver safer and more secure products, reduce time to market, increase profit margins and comply with industry standards. The Ansys Medini Analyze™ desktop product supports efficient application of quality, safety, reliability and cybersecurity analysis engineering methods at system, item, software, hardware and printed circuit board levels. It allows engineers to deliver safe and secure products. The Cloud-based product, Ansys Digital Safety Manager™, provides safety analysis accessible through the web so that teams may collaborate on the management of safety in product development, deployment and operation.

Autonomous Vehicle Simulation

Our autonomous vehicle simulation solutions are designed specifically to support development, testing and validation of safe automated driving and advanced driver-assistance systems (ADAS) technologies. This autonomous vehicle simulation solution saves time and costs versus traditional development and testing methods by allowing testing of drive designs on a virtual vehicle in a real-world environment. Ansys autonomous vehicle simulation solutions offer a set of dedicated features for sensors and headlamps for developing ADAS and autonomous systems. Designers can utilize component-level model-in-the-loop testing and can dynamically test physics-based sensor and lighting systems. Our autonomous solutions connect to popular driving simulators to recreate real-world driving conditions to test systems under variable traffic, terrain, weather and lighting conditions. The Ansys AVxcelerate™ product can generate reliable, synthetic training data enriched with ground truth information for all sensor types; this data is essential for artificial intelligence/machine learning (AI/ML)-based perception algorithm training and validation.

Digital Twin

Our Twin Builder™ product allows customers to implement complete virtual prototypes of real-world systems. These can be deployed to manage the entire lifecycle of products and assets. Our digital twin simulation paradigm allows customers to increase efficiencies over time, scheduling maintenance around predictive methodologies that become more accurate with real-world testing and response. Access to this information allows engineers to unlock additional value out of existing assets, preventing unscheduled downtime and lowering operating costs, while working at optimal efficiency.

Academic

We bundle our commercial software by physics area and work with universities to utilize our software in teaching and research. Currently, there are more than 2,900 university customers across 86 countries using Ansys. Additionally, our digital engagement strategy has evolved to include an “Access, Learn, Engage” model that is supported by our free student downloads, free Ansys Innovation Courses and Learning Forum available through Ansys Innovation Space that makes it easy for learners to access our product, learn how to use it and ask questions to their peers and our experts. We also work to develop partnerships in areas such as student team sponsorship, strategic curriculum and research opportunities and STEM.

PRODUCT DEVELOPMENT

We make significant investments in research and development and emphasize frequent, integrated product releases. These investments are made across five technology pillars: numerics, HPC, AI/ML, Cloud and experience and digital engineering. Our investments in these pillars are applicable across our portfolio and demonstrate how we are building upon our product and technology leadership to further differentiate our solutions. Even more exciting is the interplay amongst those pillars, which is benefiting customers by helping them to solve more complex challenges – while driving our growth through more users, more products and more computations. Our products also run on the most widely-used engineering computing platforms and operating systems, including Windows, Linux and most UNIX workstations. Our customers increasingly leverage GPU computing hardware and Cloud computing to solve large and complex problems. Our machine learning applications enable customers to discover details within their designs and to unlock potential new designs.

Our total research and development expenses were \$494.9 million, \$433.7 million and \$404.9 million in 2023, 2022 and 2021, respectively, or 21.8%, 21.0% and 21.2% of total revenue, respectively. As of December 31, 2023 and 2022, our product development staff consisted of 2,400 and 2,100 employees, respectively, many 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 early February 2024, we released Ansys R1 2024, which introduces an elevated user interface that facilitates collaboration, amplifies digital engineering productivity and removes barriers caused by engineering complexity. We also recently launched Ansys SimAI™ and Ansys AI+™ technologies. Ansys SimAI is a cloud-enabled, physics-neutral platform that empowers users across industries to accelerate innovation and reduce time to market. With Ansys SimAI, users are able to reliably predict performance of complex simulation scenarios rapidly. The tool allows users to first train an AI model using simulation results and then make predictively accurate analogous designs. With Ansys AI+, Ansys incorporates and extends AI features within its industry-leading desktop products to enhance core functionalities. The new AI+ offerings empower customers with more choice for how they access Ansys AI capabilities across our desktop products.

- In July 2023 we released Ansys 2023 R2, which brings enhanced computing power to optimize complex products, assemblies and systems across industries. It enables customers to get better products to market faster with systems engineering workflows to help stakeholders understand subsystem interactions. Ansys 2023 R2 enables distributed engineering teams with new technologies and improved performance to drive forward industry innovation. It combines an exceptional range of enhanced numerics capabilities, performance improvements and cross-disciplinary engineering solutions to equip organizations with advanced physics solvers, scalable GPU-based computing and seamless workflows. Ansys 2023 R2 enables users to run large jobs and help overcome hardware capacity limitations with HPC, both on-premises and in the cloud. Enhanced solver algorithms capitalized on GPUs to speed simulation. In Ansys 2023 R2, the Fluids product line enables additional industrial simulations to run natively on GPUs, substantially reducing solve time and total power consumption. For example, Ansys 2023 R2 extends multi-GPU support to sliding mesh, compressible flows and eddy dissipation model combustion simulations. That means analysis of internal combustion engines, centrifugal pumps and fans, turbochargers and compressors, stirred tanks and reactors and hydraulic machinery can now be supercharged with the Ansys Fluent multi-GPU solver.

Acquired Technologies

During the year ended December 31, 2023, we completed several strategic acquisitions to expand our solution offerings and enhance our customers' experience. The effects of the acquisitions were not material to our consolidated results of operations individually or in the aggregate. 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.

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 our 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. Our products are utilized by organizations ranging in size from small consulting firms to the world's largest high-tech and industrial companies.

Our direct sales organization develops an enterprise-wide, focused sales approach and implements 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 2023, we continued to invest in our existing domestic and international strategic sales offices. In total, our direct sales and marketing organization comprised 3,000 and 2,700 employees as of December 31, 2023 and 2022, 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 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, under the direction of our sales management team, market and sell our products to new customers, expand installations within the existing customer base, offer training and consulting services and often provide the first line of our technical support. Our channel partner certification process helps to confirm that each channel partner has the ongoing capability to adequately represent our expanding product lines and to provide an appropriate level of training, consultation and customer support. We derived 26.1%, 23.9% and 23.7% of our total revenue through the indirect sales channel for the years ended December 31, 2023, 2022 and 2021, respectively.

No single customer accounted for more than 5% of our revenue in 2023, 2022 or 2021. 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

Ansys has and continues to be committed to operating as an open platform, enabling our customers to easily integrate simulation into their R&D workflows. To further that vision, we have established and continue to pursue strategic alliances with advanced technology suppliers, cloud computing providers, hardware vendors, software vendors, specialized application developers and CAD, EDA 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, EDA, product data management and PLM systems.

We have technical 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 work with leading EDA software companies, including Altium, Cadence Design Systems, Synopsys, Siemens EDA and Zuken, to support the transfer of data between electronics design and layout software and our electronics simulation portfolio.

We have strategic relationships with public cloud providers to enable customers to seamlessly access HPC in the cloud. We have a partnership with Microsoft to develop Ansys Access powered by Azure, which will enable customers to launch Ansys products using their Azure enrollment and connect third-party tools. In addition to our joint initiatives in the cloud, we have a broader relationship with Microsoft focused on more market-specific endeavors in the area of Digital Twins, autonomy and use of AI in simulation.

We also have a strategic relationship with Amazon Web Services (AWS) to transform cloud-based engineering simulations. Ansys Gateway powered by AWS facilitates seamless access and deployment of Ansys products on AWS, making simulation workloads more user-friendly, while offering scalability and flexibility with easy access to software and storage solutions from anywhere with a web browser.

In addition to marketing relationships to promote the adoption of HPC, we maintain technical relationships with Intel, NVIDIA and AMD to optimize the solver performance and scalability of our portfolio, enabling faster simulations, better graphics and a shorter time to market for our customers. In the area of GPU computing, we have tuned and optimized the Fluent GPU and Mechanical solvers for "Hopper" GPUs from NVIDIA. With AMD, we have expanded support in the Ansys Mechanical product for the latest AMD Instinct MI200 Series accelerators, AMD's data-center-class GPU family. Support for these new GPUs gives customers more flexibility when choosing HPC hardware, both on-premises and in the cloud. As an inaugural member, we have joined both Intel Foundry Services' (IFS) Design Ecosystem Alliance and Intel Foundry Services Cloud Alliance. We expect that our EDA tools and multiphysics solutions will help IFS to deliver industry-leading bespoke silicon to their customers, both on-premises and in the cloud.

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 over 350 technology partnerships, spanning a wide range of solution areas, including materials, optimization, electronics, optical, mechanical, fluid and systems simulation, our partner ecosystem extends the depth and breadth of our technology offerings.

COMPETITION

We believe that there are many factors affecting sales of our software, including 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.

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.