



PERVASIVE ENGINEERING SIMULATION

FOR A

DIGITAL WORLD

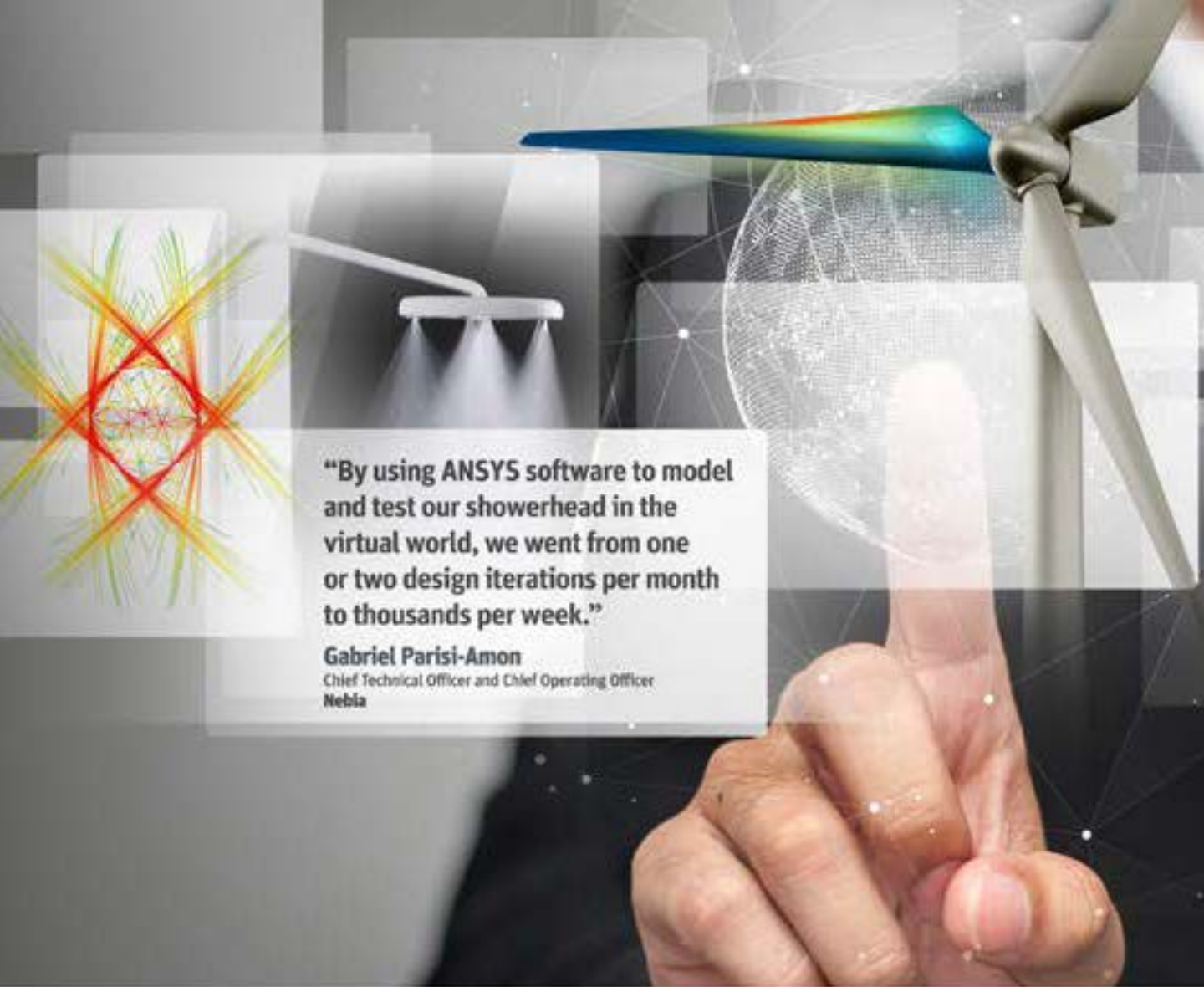
Today's products are smarter and more complex than ever – which means embracing leading-edge and proven engineering technologies.

By **Ajei Gopal**, President and CEO, ANSYS

We're witnessing a disruption in product development as the physical and digital worlds merge to generate unprecedented product innovation. Because products are smarter and more innovative than ever, how they are manufactured, brought to market and operated has been profoundly altered. In this environment, the winners will be those who master this complexity and create breakthrough products. They will leverage the best practice of pervasive engineering simulation and simulate earlier, using digital exploration to investigate a larger design space faster. Simulation

will be applied throughout the product design team, during the full process of product development and even into real-time operation.

Just as products have radically advanced, simulation software has also evolved. Only visionary companies that leverage these new capabilities will be able to transform disruption into opportunity.



“By using ANSYS software to model and test our showerhead in the virtual world, we went from one or two design iterations per month to thousands per week.”

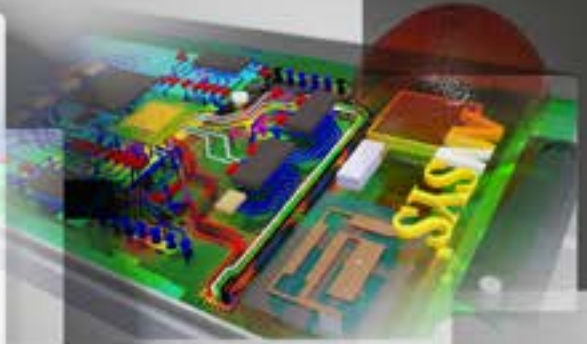
Gabriel Parisi-Amon
Chief Technical Officer and Chief Operating Officer
Nebia

Simulation: More Valuable Than Ever

Engineering simulation was first introduced over 50 years ago, but today it's making a greater and more strategic impact than ever before. The world's leading companies leverage ANSYS software to create digital prototypes of their products, simulate real-world conditions and study their response. These organizations also perform digital exploration to optimize designs before costly physical testing begins. Improvements in hardware and processing speeds allow engineers to take advantage of ANSYS solutions to consider millions of product permutations seamlessly and rapidly, without any investment in physical prototypes or testing.

ANSYS offers the only platform that truly considers multiple physical forces in an integrated fashion to more closely represent real conditions. From the structural strength of the external casing to the chips inside smart products to how components, assemblies and their environment interact, engineers can now simulate an entire system's performance. By leveraging simulation for digital exploration at the very earliest stages of design exploration — when, it has been estimated, over 80 percent of a product's final cost is determined — companies can investigate and address a broad spectrum of complex issues related to successful product design.

**We are witnessing a fundamental transformation
in engineering and product development.**



“Simulation enables us to explore multiple design variations for our engines without spending money and time on physical prototypes.”

Wayne Eckerle

Vice President of Corporate Research and Technology
Cummins

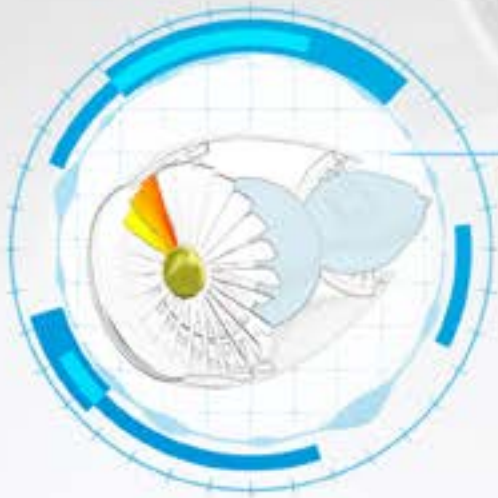
Pervasive Engineering Simulation™

However, to maximize the impact of simulation, progressive engineering teams must apply engineering simulation at every stage of the development cycle. ANSYS software supports not only engineers and analysts but every product development team member without regard to background and skillset — at companies ranging from the world’s largest corporations to startup pioneers.

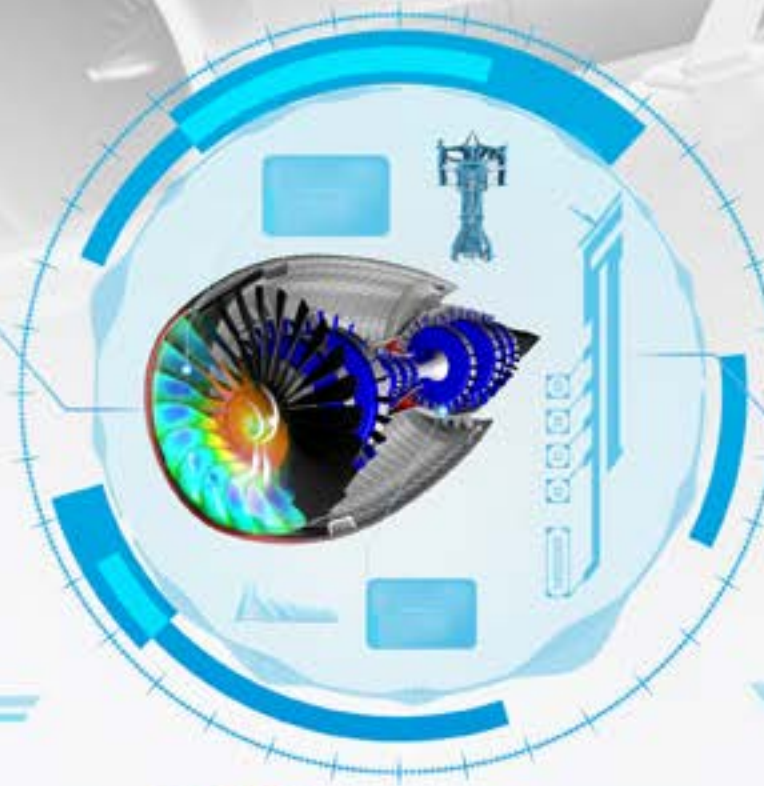
“Our engineering staff has found it so easy to use ANSYS software that we’ve ‘democratized’ simulation. Now, 75 percent of our simulation work is done by trained users, under the guidance of specialists.”

Martin Larsen
Simulation Specialist
Oticon





DIGITAL EXPLORATION



DIGITAL PROTOTYPE

Digital Twins: Simulating Products at Work

In addition to its strategic value as a design tool, engineering simulation is a key component of one of the most exciting developments in product engineering: the rise of the digital twin.

A digital twin of a working product system is created when smart sensors mounted on the product are connected to a computer model of that system in near real time. The twin system reflects the current condition of the actual product and changes during operation — reflecting wear, degraded performance or shifting conditions. When simulation is added to the digital twin ecosystem, conditions that are otherwise impossible to see and assess can be revealed.

By studying the digital twin, engineers can determine the root cause of performance problems, schedule predictive maintenance, evaluate different control strategies and otherwise work to optimize product performance — and minimize operating expenses — in near real time. Simulation is the only way to fully realize the tremendous value contained within the digital twin.

Analysts expect digital twins to drive 20 percent efficiency gains in products. Already, early adopters like GE Power are reporting significant performance improvements.

If we consider the financial impact across an entire fleet of products — or an entire industry — the potential savings associated with digital twins are staggering. For example, GE estimates that the use of Digital Power Plant Technology that includes digital twins could save \$230 million in maintenance costs over the 20-year lifetime of a turbine. Clearly the digital twin deserves the significant attention it is receiving from both product development organizations and executive teams.

Simulation is the only way to fully realize the tremendous value contained within the digital twin.



DIGITAL TWIN

The Future Is Here

Just a decade ago, we couldn't have imagined the range of smart products and intelligent functionality that we now take for granted. The merging of physical products with the digital world has transformed both our personal lives and the global engineering industry. Product developers are faced with enormous, extremely complex design challenges every day, as they seek to combine the rich features demanded by consumers with the cost concerns of shareholders — all while racing to beat the competition to market with the newest innovation.

While engineers are faced with a difficult task, their work has a huge potential payoff. The Boston Consulting Group estimates that the merger of the physical and digital worlds represents approximately \$11 trillion in new value, as the world's product development teams tap into unmet consumer needs.

Fortunately, in the race to innovate, engineering teams have access to advanced technology solutions that are designed to drive faster, more pioneering and more cost-aware product development.

About Ajei S. Gopal

Ajei S. Gopal has been president and chief executive officer of ANSYS since January 2017, and was president and chief operating officer from August 2016 through December 2016. Dr. Gopal has been a member of the company's board of directors since February 2011. Before joining ANSYS, he was an operating partner at Silver Lake; senior vice president at Hewlett-Packard; executive vice president at CA Technologies; executive vice president and chief technology officer at Symantec Corporation; and chief executive officer, a founder and member of the board of directors of ReefEdge Networks; and he held various positions at IBM Research and IBM Software Group. Dr. Gopal has a doctorate in computer science from Cornell University and a bachelor's degree in mechanical engineering from the Indian Institute of Technology, Bombay.

Engineering simulation has already been proven to offer a significant financial payback because it cuts time and costs from the product development cycle, while also reducing warranty expenses. Simulation is now widely accepted as an engineering best practice. In all, simulation software from ANSYS has supported the work of product development teams at more than 45,000 customer organizations.

Today, we are seeing engineering simulation applied in exciting new ways, facilitating such best practices as digital exploration, digital prototyping and the digital twin. Fueled by ongoing improvements in the speed and capabilities of ANSYS software, these practices will separate the leaders from the followers.

Whether we are prepared or not, the future is here. We are witnessing a fundamental transformation in engineering and product development — and that change brings challenges, but it also presents incredible opportunities. At ANSYS, we're committed to developing the simulation capabilities and best practices you need to seize those opportunities. 