

Leveraging the Full Power of Simulation

An industry expert looks at changes in engineering analysis and ways that companies can maximize benefits of the technology.



Professor Ubaldo Barberis

Professor Ubaldo Barberis, a university educator and manager of Structural Analysis and Scientific Calculation at Ansaldo Group, recently answered questions posed by Dr. Stefano Odorizzi, CEO of the engineering consulting firm EnginSoft S.p.A., a leading computer-aided engineering (CAE) service provider located in Italy. Odorizzi is a highly experienced educator and researcher as well as being a professional in the CAE field.

Ansaldo is Italy's leading producer of thermoelectric power plants operating internationally for public utilities, independent power producers and industrial companies in more than 90 countries. The company designs and manufactures equipment such as gas and steam turbines as well as electrical generators, and it provides a range of power plant services, including process, mechanical, civil engineering, construction, installation, startup, operation and maintenance, monitoring and diagnostics, and qualification. Simulation work at Ansaldo includes a wide range of analysis; examples include thermal-stress analysis and fatigue-life studies of steam turbine blades, prediction of gas burner combustion temperature distributions, electromagnetic analysis of generator coils, and seismic analysis of equipment and buildings.

When did you become involved in engineering simulation, and what aspects are you particularly interested in?

In 1971, I earned a degree in nuclear engineering from the University of Turin, where I then became an assistant lecturer on calculation and design in mechanical engineering. I subsequently applied my knowledge of finite element analysis at various divisions of the Ansaldo Group. These included Ansaldo Nucleare (Nuclear), Ansaldo Ricerche (Research) and Ansaldo Power Energia (Energy).

As a Structural Analyst and Scientific Calculation manager, I have worked with analysis technology in a broad range of applications. Since 1979, I have been responsible for the implementation of ANSYS software in

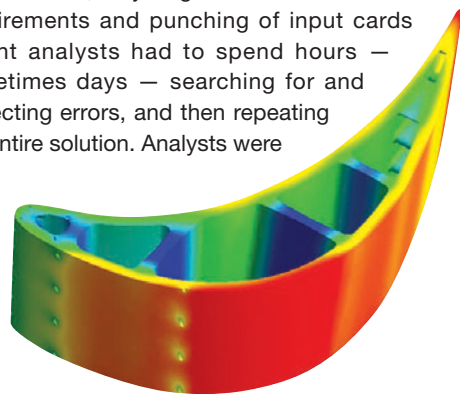
the different companies of the Ansaldo Group — the first major Italian company to use the code.

Because of my strong personal interest in both engineering simulation and education, I've dedicated part of my time to conducting seminars as professor for Finite Element Applications at the University of Perugia and University of Turin. My aim is to motivate and inspire students in the use of simulation for various structural engineering problems and, at the same time, to make them aware of any limitations of the technology.

How have technology and engineering analysis jobs changed during the last 30 years?

Simulation went through big changes in the 1970s and the first half of the 1980s. Analysts primarily used punch cards for data entry and tabulated plots of results printed out on continuous paper. Computer hardware capabilities were very limited, so wait times were painfully long while room-size mainframes slowly plodded through problems — and for large numbers of users.

In those days, a high level of competency in computer science was usually required to get meaningful analysis results. Engineering analysts generally needed to modify the source code for performing post-processing operations that generated output data in the required format. Also, any slight mistake with RAM requirements and punching of input cards meant analysts had to spend hours — sometimes days — searching for and correcting errors, and then repeating the entire solution. Analysts were



Engineering simulation is a critical part of thermoelectric power plant development. This example shows a temperature distribution on a steam turbine blade derived from fluid dynamics and thermal-stress analyses followed by a creep and fatigue-life study.

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— Ubaldo Barberis
Ansaldo Group

able to obtain a considerable amount of information, but calculations were done mostly to verify a design at the late stages of the cycle rather than to optimize design concepts.

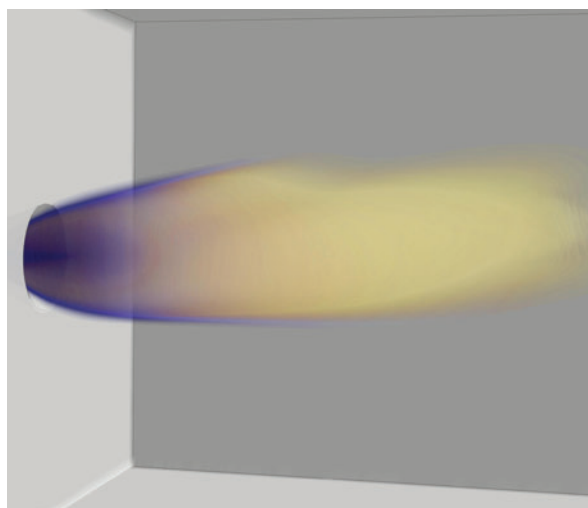
Today, compute power is orders of magnitude greater, analysis software has much more functionality, and user interfaces are significantly improved. This new simulation paradigm enables engineers as well as dedicated analysts to use these tools to quickly compare alternatives, predict problems and refine designs up front in development instead of waiting until later when projects are nearly finalized.

How do you think users would best obtain insight into simulation accuracy?

Training is crucial, of course, in the form of seminars geared to beginners, experts or managers. In many cases, these can be done online. Also, it's very important for users to exchange information and ideas with peers through user groups, discussion groups, trade association meetings and other opportunities that might bring them together.

Technology transfer and guidance can also be provided by expert users and project managers who suggest solutions, standardize analysis procedures within the company and implement new approaches to problems. Such an environment also must have effective two-way communication between managers and day-to-day users of simulation technology for technology transfer to take place and for managers to stay close to the types of problems that users face.

Software distributors also play a key role in providing technical support, applications assistance, and guidance in solving unusual and out-of-the ordinary problems. The distributor may foster relationships between technical users at different companies to exchange experiences and develop analysis competencies, as is done in the Italian ANSYS advisory meetings organized by ANSYS channel partner EnginSoft S.p.A., for example. All these aspects are crucial in leveraging the full power of engineering simulation.



Following fluid dynamics analysis of a low-NO_x burner, a color-enhanced image indicates how a simulated flame should appear in reality after high-temperature zones have been eliminated.

Would you characterize engineering simulation as an investment for companies?

Simulation software is indeed an investment that must be carefully planned and executed, similar to a manufacturing production line. Companies must coordinate maintenance, implement updates, and ensure that hardware and software run smoothly without interruptions or unforeseen stoppages that can disrupt daily work.

The breadth and depth of software functionality must be carefully evaluated. Also, companies must consider the longevity and reputation of the vendor in the global industrial arena. In this sense, the decision should be viewed as a long-term commitment — keeping in mind that the wrong decision can lead to significant delays, lost revenue and far-reaching repercussions resulting from analysis mistakes. Conversely, selecting best-in-class simulation software and implementing the code properly enables the company to effectively use the technology for a significant competitive advantage in terms of product quality, cost, innovation, speed to market and brand value. ■