A SYSTEMATIC APPROACH

Oil and gas leader FMC Technologies is making a science out of systems-level simulation. Multiphysics Simulation Manager Ed Marotta discusses the company’s unique approach — which includes certification for analysts and best-practice sharing that spans the globe.

By ANSYS Advantage staff

Recently named by Forbes magazine as one of the Ten Most Innovative Companies in America, FMC Technologies operates 27 production facilities in 16 countries. Its three tech centers in the United States, Norway and Brazil leverage corporate knowledge to develop smarter product and systems designs.

Based at the U.S. Tech Center in Houston, Ed Marotta directs FMC’s Multiphysics Simulation Group. This team was formed to maximize the impact of systems-level multiphysics simulations at FMC, enabling the company to quickly and efficiently advance its products and technologies by rapidly modeling, verifying and introducing industry-changing innovations.

“We focus on optimizing energy production technologies for both subsea and ocean-surface environments,” said Marotta. “Obviously, there are many physical forces at work in these environments. We must consider external factors such as water temperatures, subsea ocean currents, hydrostatic pressures and fluid–structure interactions — as well as internal electromagnetics and fluid dynamics within our equipment. It’s not enough to consider just one force; we need to look at the impact of multiple physics and their interactions.”

Because the oil and gas industry is very competitive, FMC relies on engineering simulation tools from ANSYS. Marotta explained, “Here in Houston, we simply can’t build physical prototypes or run systems testing in a water tank — it would be prohibitively expensive. And our reliance on simulation keeps growing as innovation becomes more and more critical. The same is true for our other global engineering centers, which are tackling different but just as complex engineering challenges.”

Even though FMC’s global teams are working on different problems, they collaborate and share knowledge on the most complex and pressing engineering challenges.

This web-exclusive article describes specific projects that FMC Technologies centers in The Netherlands, Brazil and the United States are undertaking.

You can read the entire conversation with Marotta in the print version of ANSYS Advantage magazine.

We work in a very competitive industry, and we have great confidence that ANSYS will help us build and maintain our engineering leadership.

FMC Technologies engineers in Brazil use ANSYS Mechanical to identify areas of stress and ensure that loads are not transferred to piping.

The Singapore team conducted a 3-D CFD erosion analysis for a subsea recovery tree. The goal was to verify that proposed erosion allowances in piping and fittings were sufficient.
The Netherlands
Perfecting Gas–Liquid Phase Separation in Inline Separators

Engineers at FMC Technologies in The Netherlands maximize performance of mixed-flow inline separators that separate gas and liquid in pipe segments via the cyclonic effect. Inside the pipe, flows are put into rotation by a nonrotating swirl element consisting of several curved blades. The generated centrifugal force pushes the gas phase toward the center, where it is extracted via a central outlet. Engineers rely on ANSYS Fluent to improve their understanding of multiphase flow and separation processes, which can impact both future product design and process changes. Engineers validate CFD results through experiments that confirm trends identified during simulations with identical process conditions. Simulation results also are compared with high-speed video recordings and wire mesh measurements.

Brazil
Optimizing Steady-State and Transient Thermal Performance

FMC Brazil engineers employ ANSYS Mechanical software in combination with ANSYS Fluent to understand the thermal effects of ocean currents on subsea trees. By mapping the external convective coefficients for a specific customer site and tree design, they can ensure that thermal properties are optimized in both steady and transient states. If not for ANSYS software, the team would have to perform empirical calculations that have a high degree of uncertainty. ANSYS tools give these FMC engineers a high level of certainty and confidence as they analyze the integrity of the entire system as well as isolated components that are subject to various structural and thermal conditions.
FMC analysts used ANSYS Fluent coupled to ANSYS Mechanical software to simulate long-term fatigue caused by multiple physical forces. This fluid–structure interaction analysis represented a complex problem that could not have been studied in any other way. By subjecting the jumper to a range of internal volumetric flow rates, FMC pinpointed very specific areas of stress and predicted with a high degree of confidence that the jumper design could withstand these stresses and, thus, achieve fatigue life requirements.