

SIMULIA Product Strategy for Energy Innovation

Solutions for Realistic Simulation, Design Optimization, and Simulation Lifecycle Management

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Images courtesy Pelamis Wave Power Ltd.

Energy sources are becoming increasingly diverse, and require a wide range of engineering solutions to meet industry challenges—such as extracting oil from deeper offshore locations; designing safer, longer-lasting nuclear plants; and making solar, wind, wave, and other alternative energy sources more economical.

These energy development challenges are being driven by a combination of events, including an increase in environmental awareness, the drive of various nations to be “energy independent,” fluctuations in the price of oil and gas, and the rapid increase in worldwide energy usage. Every segment of this industry is faced with the demand to develop more cost-effective, reliable, and sustainable technologies to meet current and

future energy demands. Energy companies are aggressively seeking to apply new and innovative engineering solutions to meet regional and world demand for energy.

SIMULIA’s realistic simulation solutions are playing a critical role in helping the industry meet these challenges. Our robust design simulation tools are helping oil exploration companies tap into deepwater energy resources. We are enabling alternative energy systems to be developed economically through fast, affordable virtual testing technology. Our solutions are also extending the use of traditional energy sources by enabling evaluation of stress, fracture, and failure of existing components under severe operating scenarios that cannot be tested in real life.

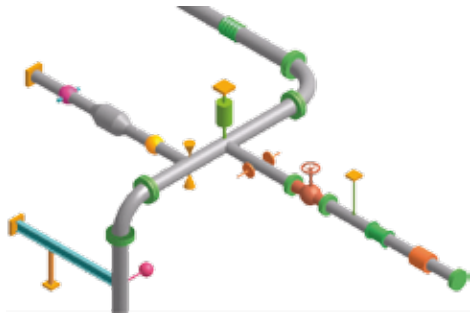
Expanding realistic simulation capabilities

Our products, such as Abaqus FEA and Isight, are used extensively throughout the energy industry for a very broad range of applications, including oil and gas geomechanics, offshore platform analysis, gas and steam turbine design optimization, nuclear energy safeguards evaluation, wind

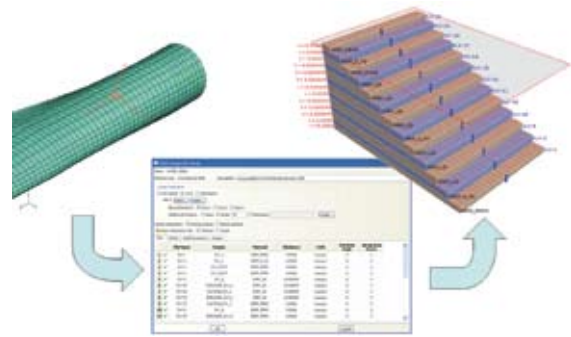
turbine blade and tower design, concentrated photovoltaic systems for solar energy, and wave energy converter development.

Abaqus FEA is well-suited to energy applications due to capabilities such as advanced material models, general contact, implicit and explicit dynamics, multiphysics simulation (such as fluid-structure interaction, coupled pore pressure-stress, and coupled thermal-stress), composites modeling and analysis, flexible multibody dynamics, and high-performance parallel solvers.

Isight is an established industry tool for creating simulation process flows (consisting of applications such as CAD, FEA, and CFD) and automating the exploration of design alternatives to identify optimal performance parameters. Fiper is an add-on product to Isight that enables users to share process flows, distribute and parallelize their execution across compute resources, and share simulation results (see *INSIGHTS* p. 9). We have also released Isight for Abaqus, which allows Abaqus users to leverage the power of Isight for design exploration and optimization.



The number and locations of hangers in a complex power plant piping system can be optimized to meet stringent earthquake requirements while minimizing cost by using Isight with Abaqus or third-party products.



Abaqus can be used to specify and visualize composite layups with varying material properties, thickness, and orientations, capabilities that are needed for the study of wind turbine blades. (Image courtesy of Energy Research Unit – Rutherford Appleton Laboratory)

Industry applications

The nuclear industry has used Abaqus FEA for decades because it provides accurate solutions and sophisticated capabilities, such as fracture analysis and material models for plasticity/creep analysis of metal and concrete, which meet the demanding quality standards for plant design, construction, and maintenance. It is used throughout the entire lifecycle of a plant, including evaluation of reactors, piping, and turbines; safety assessments of accident scenarios, earthquakes, or impact events; evaluation of storage options for spent nuclear fuel; and for safe decommissioning.

Wind energy engineers use Abaqus for simulating wind turbine systems and structures. Applications include analyzing wind turbine blades, towers, foundations, bearings, drivetrains, and braking systems. Many of the applications in this industry are similar to those in other industries—the evaluation of offshore wind foundations draws upon many features used by the oil and gas industry, including capabilities for soil-structure interaction and fluid-structure interaction. Blades are being made of new, lightweight composite materials that can be analyzed using extensive Abaqus modeling and simulation capabilities that have been developed for the aerospace industry. These capabilities include the definition of layups and the visualization of results, such as stresses, within individual plies. Abaqus provides a wide range of element types (such as solids, shells, and continuum shells), material models, and failure analysis techniques (such as VCCT, the Virtual Crack Closure Technique, and cohesive elements) to provide comprehensive composites simulation capabilities that enable engineers to analyze the strength and durability of blades under various operating conditions.

Isight has a strong history of use in the turbomachinery industry and provides

significant capabilities that are beneficial to the development of new wind power systems. Its simulation process automation and design optimization capabilities can be applied in the analysis of turbines to perform sensitivity studies, identify optimum design parameters, and quickly meet engineering targets.

The need for SLM

To achieve confidence in simulation results, engineers must apply and reuse standard analysis methods. Additionally, with the increasing complexity of simulation models, growing use of optimization techniques, and affordability of high-performance computing, engineers are creating larger amounts of simulation-related data. The new Simulation Lifecycle Management (SLM) tools from SIMULIA enable individuals, workgroups, and large enterprises to manage simulation processes, applications, data, and results. SLM provides unique online collaboration capabilities that allow distributed engineering teams to share simulation methods, models, and results in order to make better-informed design decisions. These capabilities offer significant benefits to the energy industry as a whole, but have particular importance to the nuclear energy field, where long-term traceability of simulation results and their impact on design decisions for plant maintenance and operation is critical.

Customer-focused strategy

As our technology capabilities and product portfolio grow, it is critical that our solutions meet the needs of the energy industry. We are closely engaged with our customers to understand their processes and simulation requirements. The goal of our technical marketing team is to drive appropriate customer-requested enhancements into our products, develop strong customer alliances, and continue to expand our product portfolio as necessary to be the realistic simulation leader in the energy segment.

Innovative, cost-effective development of traditional and emerging energy sources requires the use of state-of-the-art design and simulation solutions such as Abaqus, Isight, and SLM. SIMULIA's solutions are enabling engineers to evaluate real-world behavior of a diverse array of energy-generating equipment and make rapid—and accurate—performance-based design decisions to help meet energy needs today and in the future.



Mahesh Kailasam – Energy Industry Lead, SIMULIA

Mahesh is responsible for developing and directing SIMULIA strategy for the Energy Industry. He has over 10 years of experience in engineering simulation, achieved through various roles in SIMULIA Customer Services, Development, Product Management, and Strategy. He has a PhD from the University of Pennsylvania and a B.Tech from the Indian Institute of Technology, Madras (Chennai).

For More Information

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