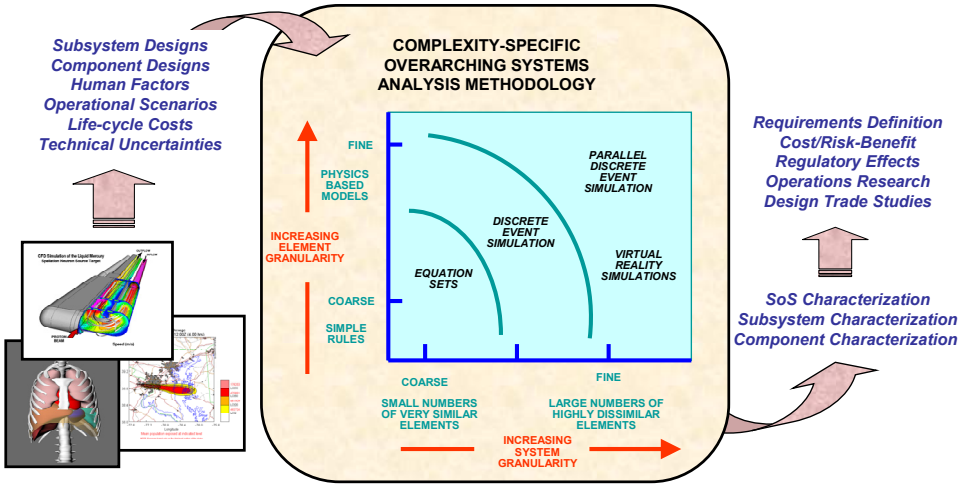
OAK RIDGE NATIONAL LABORATORY FACT SHEET
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

Scientific Computing Within the ORNL Modeling and Simulation Group: Systems Simulation

The ORNL Modeling and Simulation Group (MSG) develops sophisticated numerical solutions for a wide range of scientific, engineering, and operational applications. MSG's core competency is computational physics and engineering, and within this context we have extensive experience modeling engineering systems (ES) as well as complex highly integrated system-of-systems (SoS). Because MSG's scientific and numerical expertise includes both physics-based modeling and systems-simulation capabilities, we can address essentially any application, at any level of systems granularity, to any level of numerical sophistication, and at any point in the R&D-Design-Operations spectrum. To assist in these analyses, MSG develops general-purpose complexity-specific analysis capabilities; that is, overarching simulation frameworks capable of accommodating a broad range of problem sizes. This analysis scope varies from systems with small numbers of similar elements possessing course definitions of element functionality and limited trade spaces, to systems with thousands of dissimilar elements possessing detailed representations of element functionality and massive trade spaces. Specific MSG ES/SoS problem solving experience includes the following.

- Development of general-purpose and problem-specific overarching systems-simulation software using physics/science-based simulations, dynamic-discreet-event simulation, coupled discreet-event/physics-based simulations, intelligent virtual simulations, as well as UML/XML/OCL-based model-driven architectures.
- R&D, industrial, manufacturing and military systems at the component, subsystem, and SoS level.
- Deterministic, probabilistic, economic, and/or optimal figures-of-merit for requirements-definition, engineering-design, and programmatic decision making.
- A diverse set of applications including nuclear power/research reactors; fusion energy; nuclear weapons manufacturing; conventional weapons systems; gaseous-diffusion, gas-centrifuge, and atomic-vapor uranium enrichment processes; autonomous measurement and control systems; energy infrastructures; communications networks; as well as facility vulnerability studies.

These applied scientific computing capabilities represent an extremely versatile systems simulation resource for a broad range of R&D, industrial, homeland defense, and military applications. We welcome the opportunity to discuss your potential applications and ways MSG can contribute to a solution.



Coupling physics-based models with complexity-specific analysis software allows MSG to integrate design data, expert knowledge, programmatic objectives & constraints, operational criteria, & technical uncertainties into a coherent simulation framework to examine the non-linear performance of even the most complex highly-integrated system-of-systems for both scientific & programmatic decision making

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