Scientific Computing Within the ORNL Modeling and Simulation Group: Engineering Systems Analysis - Gas Centrifuge and Uranium Enrichment Analysis

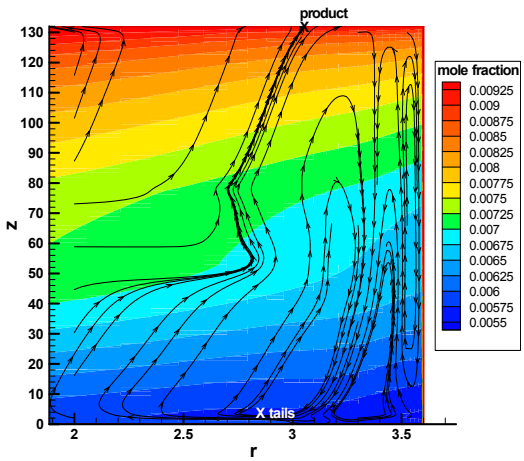
The ORNL Modeling and Simulation Group (MSG) develops sophisticated numerical solutions for a wide range of scientific, engineering, and operational applications. MSG's core competency is computational physics and engineering, and within this context we have extensive expertise modeling uranium-enrichment processes for R&D, engineering design, and operational applications. This problem-solving scope includes gaseous-diffusion, gas centrifuge, and AVLIS technologies with the following specific applications.

- Creep deformation analysis of gas centrifuge enrichment program (GCEP) composite rotor.
- Software development and design optimization studies of GCEP cascades and cascade trains. MSG staff are currently conducting cascade and train design optimization studies for USEC/GCDP using this software.
- Heat transfer modeling of AVLIS materials handling development module, GCEP product/tails withdrawal cold trap, and UF_6 storage cylinders.
- Nuclear criticality safety analyses of plant and subsystem designs for GCEP and multi-site gaseous diffusion plants (GDP).
- Computational Fluid Dynamics model development and execution for design optimization studies of GCEP centrifuge separation performance and flow stability. MSG staff are currently supporting these same analyses for USEC/GCDP using this software.
- Software development and analysis of GDP thermal systems for operational, capacity expansion, power recovery, and Freon replacement applications.
- GCEP plant scheduling and cost studies, conceptual studies of advanced GCEP applications, and participation in the original GCEP/AVLIS peer review and down-selection process.

Additionally, MSG possesses extensive general-purpose computing resources that would be especially useful for any detailed analysis of gas-centrifuge plant operation. Two example capabilities are the **VISAC** facility vulnerability code and the **COMPASS** systems analysis software suite.

- **VISAC** predicts site and regional consequences of incidents at nuclear, biological, and chemical facilities. It could be used, for example, to estimate the environmental and human-health effects of industrial accidents as well as man-made or natural disasters at gas-centrifuge enrichment plants.
- **COMPASS** is an event-simulation based systems analysis code that could be used with existing GCDP process models to determine, for example, the most-likely separative-work performance for an arbitrary gas-centrifuge plant design.

These applied scientific computing capabilities represent an extremely versatile modeling and simulation resource for the analysis of essentially any gas-centrifuge technology and/or enrichment-plant operational philosophy. We welcome the opportunity to discuss your potential applications and ways MSG can contribute to a solution.



MSG developed specialized software & conducted design studies to maximize UF_6 flow stability & separative work in prototype uranium enrichment gas centrifuges

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