Kraken - the Serpent-based multi-physics framework: features, capabilities and applications

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Kraken is a multi-physics coupling framework built around Serpent-based high-fidelity and reduced-order calculation sequences. It provides an interface for exchanging input and output data between modular solvers and supports external coupling to system-scale simulations. Communication between the solver modules is handled using Python packages that provide methods for socket-based communication, field data exchange, iteration algorithms, and related functionality.

The Kraken framework is designed to be code-agnostic, but the distribution package includes solvers natively developed for the coupling. Kraken is distributed free of charge for non-commercial research and educational use via the OECD/NEA Data Bank and RSICC, and with a separate license for commercial applications.

The workshop focuses on the reduced-order Serpent-Ants calculation sequence developed for core-level fuel cycle simulations and transient analyses. The main topics include:

- General overview of Kraken and the Ants nodal neutronics code
- Demonstration of methods and procedures for group constant generation
- Features and capabilities available for fuel cycle simulations
- Upcoming system-scale coupling (e.g. with TRACE and Apros)

In addition to calculation sequences, the workshop covers tools and methods available in Kraken, including a new interactive 2D/3D Serpent plotter.

The workshop is intended for anyone interested in reactor analysis, such as Serpent users wishing to expand from neutronics to coupled simulations. Due to export control limitations, the workshop does not include hands-on exercises.