

kugelpy: Revolutionizing Pebble Bed Reactor Simulations with High-Fidelity Modeling

kugelpy provides an unparalleled framework for high-fidelity, time-dependent simulations of pebble bed reactors, enabling accurate modeling of reactor dynamics and fuel management.

kugelpy emerges as a groundbreaking Python-based framework designed for the detailed simulation of pebble bed reactors (PBRs), integrating with Serpent to offer a comprehensive tool for reactor physicists aiming to analyze reactor run-in phases and approach to equilibrium with unprecedented accuracy.

Pebble bed reactors represent a class of advanced nuclear reactors with unique fuel management and operational characteristics. The complexity of simulating the dynamic behavior of PBRs, including pebble movement, refueling, and discharge, necessitates a sophisticated approach. kugelpy addresses this challenge by providing a methodology for creating Serpent input files and tracking reactor physics quantities for time-dependent simulation, bridging a significant gap in nuclear reactor modeling tools.

kugelpy is a Python module that operates in conjunction with the Serpent Monte Carlo code, enabling detailed neutronics calculations and the simulation of pebble movement within the reactor core. This tool facilitates the entire process of a PBR's run-in, from initial fueling to equilibrium, capturing the intricate dynamics of fuel cycling and reactor behavior. As the sole code system known to encapsulate such comprehensive functionality around high-fidelity neutronics simulation, kugelpy stands as a critical resource for reactor physicists seeking to validate and refine PBR models.

Advantages

- **High-Fidelity Simulations:** Enables precise modeling of PBRs through integration with Serpent for neutron transport calculations.
- **Dynamic Fuel Management:** Accurately simulates pebble movement, refueling, and discharge processes.
- **Time-Dependent Analysis:** Provides capabilities for studying the reactor's approach to equilibrium over time.
- **Unique Verification Tool:** The only known software that allows for detailed code-to-code verification in the context of PBR simulations.

Applications

Category

Modeling and Simulation

Nuclear Power Plant Safety

Learn more



- Reactor Physicists: For conducting detailed simulations and analyses of pebble bed reactor behavior and fuel cycle management.
- Academic Research: As a teaching and research tool in nuclear engineering programs focusing on advanced reactor designs.
- National Laboratories: For validating reactor models and developing new strategies for PBR operation and safety.
- Industry Professionals: In the design and optimization of PBRs, ensuring efficiency and compliance with safety standards.

Leverage the power of kugelpy for your pebble bed reactor simulations to achieve unparalleled accuracy in modeling and analysis. Join the forefront of nuclear reactor research and development by integrating kugelpy into your simulation toolkit today.

This software is open source and available at no cost. [Download Now](#)