ENERGETICS

Ammin/Newcleo - Advanced techniques for cross section preparation in lead-cooled fast reactors

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Context of the research activity	The research activity of this proposal regards the optimization and validation of numerical techniques for the preparation of neutron cross sections for LFR full-core analysis with the open-source, deterministic code DRAGON. The adoption of this code is very important to support the design phase of the reactor envisaged by the company newcleo, co-founder of this project, as it allows parametric calculations with modified conditions with high computational efficiency, thus speeding the reactor physics aspects of the core design process.
Objectives	The main objective of this PhD project is to validate the numerical schemes implemented in DRAGON to produce the multi-group neutron cross sections used as input data for full-core analysis. The second objective consists in the optimization of the computational efficiency with the adoption of state-of-the-art computational practices, e.g. the adoption of CPU- and GPU-based parallelisms. After this phase, which requires to extend the code, the validation of DRAGON will be carried out. To achieve this goal, reference deterministic and Monte Carlo calculations and experimental data available in the literature on liquid-metal cooled fast reactors will be used. Initially, the candidate will follow a top-down approach, subdividing the computational chain available in DRAGON in many sub-tasks to identify the flow of input and output data and to assess the possible discrepancies by comparison with reference Monte Carlo calculations. When considerable discrepancies are found, the candidate will implement more accurate numerical schemes, customized to LFR application, and will iterate on the validation procedure. The final stage of the research project should be focused on the adoption of the cross sections generated with DRAGON for full-core calculations, aiming at reproducing both integral and local experimental data available in the validation test suite defined by newcleo to comply with the safety authority.
Skills and competencies	Background in nuclear engineering and/or applied physics, with documented competencies in the fundamentals of reactor physics and familiarity with

competencies for the development of the activity	Monte Carlo and deterministic neutronic modelling, both at fuel assembly and full-core scale. The candidate should be willing to interact and work in an international team. Programming skills in Python are also very welcomed.