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## the simulation of reactor physics for China Experimental Fast Reactor

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China Experimental Fast Reactor (CEFR) is the first fast neutron breed reactor in China, which is different with PWR. In order to research the operational performance of CEFR, the real-time simulator was developed. The simulation of core physics is an important part of the simulator.

The neutron dynamic model used in the simulator is three dimensions and four groups neutron diffusion model, which was solved by the improved quasi-static approximation node method. The neutron flux was divided into shape function and amplitude function. The shape function changes slowly with time, so a large time step is adopted. And the amplitude function changes quickly with time, so a small step is adopted. The calculation time can be saved, it is important for real-time simulation. According the character of CEFR, the core was divided into many nodes. The homogenization parameters of each node were calculated by HELIOS. Considering influences of fuel burnup, fuel temperature and coolant temperature on fuel assembly cross section, four-order polynomial is adopted for fitting.

Because there are hexagonal fuel assemblies in CEFR core, the calculation of leakage term was modified based on the pressurized water reactor calculation program. The improved alternative direction implicit (ADI) algorithm is used to solve diffusion equations. The simulation result indicates that the improved algorithm is able to meet requirements for the real-time simulation.

Two steady states (BOL and EOL) were simulated. And some dynamic operation cases were simulated, including reactor start-up and a control rod drawing out of core without control. Compared with the Final Safety Analysis Report for CEFR, the three-dimensional power distribution and control rod value are in good agreement. The core physics simulation program is able to use the operation research of CEFR.

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