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Smooth Startup Problem for Innovative Fast Reactor Working in Nuclear Burning Wave Regime

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The results of optimization of the smooth start-up method for the innovative fast reactor (FR) working in the nuclear burning wave (NBW) regime (known also as a Traveling Wave Reactor) are presented. This method has to prevent the excessive increase of neutron flux and energy production in FR at the stage of establishing self-sustained NBW regime mainly due to the lack of neutron-absorbing fission products at this stage compared with the steady-state NBW regime.
The problem is studied by means of numerical simulation of the initiation and evolution of NBW in such a reactor with metallic U-Th fuel. For this simulation we use the deterministic approach, developed in [1], and based on solving the non-stationary neutron diffusion equation using the effective multi-group approximation together with a set of burn-up equations for fuel components and equations of nuclear kinetics for precursor nuclei of delayed neutrons. The selection of the ignition zone compositions that provides a smooth start-up of the NBW reactor is carried out. The features of the initial stage of the NBW reactor are studied in detail.

1. S.P. Fomin et al., Ann. Nucl. Energy, 32 (2005) 1435; Prog. Nucl. Energy, 50 (2008) 163; 53 (2011) 800.

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