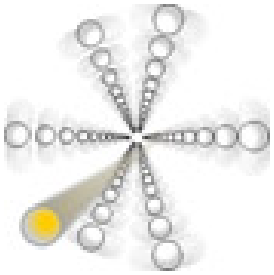

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Phenomenon of Neutron-Fission Wave in Multiplicative Medium

A great interest for the future power engineering presents the development of new concepts of nuclear fission reactors with the so-called intrinsic safety, in which the development of uncontrolled chain nuclear reaction is impossible due to the physical principles of their operation. One of such concepts, proposed by Lev Feoktistov in 1988, is based on the phenomenon of self-sustained neutron-fission wave in a multiplicative medium [1]. The critical state in such a reactor is kept automatically without external control due to the negative reactivity feedback inherent in this non-linear regime of the neutron-fission wave propagation. Several research groups study this phenomenon using different approaches and different names for it: deflagration wave [2], CANDLE [3], nuclear burning wave (NBW) [4] etc. Lately, the most frequently used name is the "Traveling Wave Reactor"due to the TerraPower and Bill Gates activity [5].

We present here the results of our investigation of the neutron-fission wave phenomenon, which was carried out on the basis of numerical solution of non-stationary nonlinear diffusion equation for neutron transport in a multiplicative medium together with a set of the burn-up equations for fuel components and the equations of nuclear kinetics for precursor nuclei of delayed neutrons. A notable stability of the NBW regime relative to disturbances of the neutron flux in the system has been shown. This stability is conditioned by the above-mentioned negative reactivity feedback which is inherent in this regime .

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