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Some results of using partial equations for calculations of transient processes in fast breeder reactors

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Calculations of non-stationary processes of fast neutron reactors taking into account the spatiotemporal dependence of the neutron field is a rather complex process due to the significant influence on the calculation results of delayed neutrons, which make up a very small, less than a percent, part of all the neutrons of the reactor in its critical state. This circumstance is due to the fact that the spectra of all neutrons, both prompt and delayed, are in the working range of the reactor's neutron spectrum, in contrast to thermal neutron reactors.
The author's use of solutions to a system of partial equations for estimating transient processes shows the influence of differences in time changes in the form functions of prompt and delayed neutrons on the estimation of transient processes (physical characteristics) of a fast-breeder reactor, for example, the reactivity of the reactor. By partial equations, the author understands a system of separate equations for prompt and each of the groups of delayed neutrons, as well as, if necessary, neutrons of an external source.
The results of using partial neutron transfer equations for estimating the time behavior of a fast reactor are presented on the example of computational studies of test models of the MET1000 and MOX1000 fast breeder reactors developed within the framework of the Generation-IV project.
The paper shows that in transient processes, for example, during the discharge of control rods, due to the difference in the form functions of prompt and delayed neutrons, the real reactivity introduced by the rods exceeds the reactivity obtained from calculations of stationary problems by 5-10%, depending on the type of fuel in the reactor (MOX and uranium fuel).

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