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Optimization problem for characteristics of fast reactors operating in a closed fuel cycle

Results of the analysis of the optimization problem for characteristics of fast reactors operating in a closed fuel cycle are presented.
The optimization problem is proposed to solve in two stages. At the first stage, multiple calculations of characteristics of fast reactors are carried out using a variety of characteristics of the fuel returned to reactor from a closed nuclear fuel cycle, such as the content of fission fragments, the uncertainty in determination of the concentration of fissile nuclides in the returned fuel, etc. At the second stage, the optimization problem is solved directly by selecting the most appropriate characteristics of the reactor from multiple sets of obtained characteristics.
There are different approaches to solve the optimization problem for an objective function, which does not have predetermined analytical dependence on its parameters. One way or another, multiple calculations of function values at different sets of parameters are assumed. The following approach seems to be the least complicated in the case of a large number of optimization variables. Analytical approximation of the dependence is based on a previously calculated set of examples of the parameter values corresponding to the function values. Finally, when the approximation is constructed, the classic gradient methods are used to solve the optimization problem.
As an example of solving the optimization problem the reactor EBR-II with a metal fuel returned to the reactor with the contents of the fission products after recycling is considered. The influence of the uncertainty in determination of the nuclides concentration on the reactor characteristics is shown.

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