

新能源与分布式发电

基于PSASP的核反应堆数学模型及其动态响应特性

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摘要:

根据核反应物理原理推导出了核反应堆数学模型, 包括中子动力学模型、燃料和冷却剂温度模型2个部分。在PSASP环境下对核反应堆进行了建模和仿真计算。仿真结果表明, 由于温度效应和中毒效应的存在, 核反应堆对反应性阶跃扰动和冷线温度阶跃扰动有一定的自稳定性, 该特性满足核反应堆在设计时的目标。今后可将上述模型与核电站其他部分模型在PSASP内整体封装, 以便进行电力系统动态分析。

关键词:

A Mathematical Model of Nuclear Power Reactor and Its Dynamic Response Based on Power System Analysis Software Package

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Abstract:

According to physical principle of the nuclear reaction, a mathematical model of nuclear power reactor (NPR) is deduced, including the neutron dynamic model and fuel/coolant temperature model. In the environment of power system analysis software package (PSASP), the modeling and calculation of NPP are conducted. Simulation results show that due to the temperature effect and poisonous effect of NPP core, NPP possesses certain self-stability in reactive step perturbation and cool-line temperature step perturbation that satisfies design objective of NPP. Henceforth, above-mentioned model can be integrally packaged with the models of other parts of nuclear power plant in PSASP in order to carry out dynamic calculation of power system.

Keywords:

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