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反应堆工程

核电厂中流固耦合现象数值模拟研究综述

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摘要 流固耦合现象在核电厂中广泛存在，该现象引起的结构动力学问题对核电厂结构完整性和安全性有重要影响。目前，国内外对核电厂中流固耦合现象的研究给予越来越多的关注。本文介绍华北电力大学在该方面的一些研究进展，例如，快堆燃料组件抗震分析新的流体附加质量计算方法研究；蒸汽发生器换热管双管漩涡脱落的数值模拟；一个先进堆燃料组件平行板上流动引起的漩涡脱落数值模拟；由地震引起的自由表面对快堆主容器冲击现象的研究；移动粒子法求解液面晃动及晃动引起离散现象的研究等。

关键词 流固耦合 抗震分析 漩涡脱落 液面晃动 移动粒子法

分类号

Review of Research on Numerical Simulation for Phenomena of Fluid-Structure Interaction in Nuclear Power Plants

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Abstract The phenomena of fluid-structure interaction exist widely in nuclear power plants. Structural dynamic problems caused by those phenomena have important influence on the structure integrity and safety of nuclear power plants, which attract more and more attentions on this aspect at home and abroad now. North China Electric Power University (NCEPU) has been doing some related researches. The paper introduces some researches, such as a new method to calculate the added mass for the seismic analysis of the fuel assembly in fast breeder reactor (FBR), simulation on the vortex shedding of double heat exchange tubes in a steam generator, simulation on the vortex shedding caused by the cross -flow over plates in a fuel assembly of an advanced reactor, the research on the impacting phenomenon of the free-surface on the vessel head in a storage tank as the main vessel of the China Experimental Fast Reactor (CEFR) shaken by the earthquake, and the researches on the solution of the liquid sloshing by moving particle semi-implicit (MPS) and the scattering phenomenon caused by sloshing, and so on.

Key words fluid-structure interaction _ seismic analysis _ vortex shedding _ liquid sloshing _ moving particle semi-implicit

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