

反应堆工程

湍流模型在堆芯热工水力性能分析中的应用

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摘要 针对正三角形布置堆芯棒束燃料通道内冷却剂充分发展湍流流场模拟, 对比分析了计算流体动力学软件湍流模型对复杂流道内湍流流场模拟结果的影响。结果表明: 湍流模型选取的不同对模拟结果有着显著影响, 由于堆芯几何结构复杂, 冷却剂流动为复杂三维流动, 湍流呈高度各向异性。基于各向同性假设的湍流模型不能准确捕捉堆芯内冷却剂的二次流现象。基于求解雷诺应力输运方程的雷诺应力模型 (RSM) 能够较好地预测复杂流道内的二次流。本工作的研究结果为复杂流道流动换热模拟及深入研究分析堆芯热工水力性能提供了一定借鉴和指导。

关键词 [湍流模型](#) [复杂流道](#) [二次流](#) [数值模拟](#)

分类号

Application of Turbulence Models in Thermal-Hydraulic Analysis of Reactor Core

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Abstract Numerical simulations were performed on developed turbulent flow through reactor fuel assembly in equilateral triangle lattice, and impacts of different turbulence models built-in computational fluid dynamics upon simulation results of flow field in channels with complicated geometry were analyzed. The results show that simulation result greatly depends on the choice of turbulence model. Due to the complicated geometrical construction, the complicated three-dimensional turbulent flow shows highly anisotropic characteristics. Turbulence models assuming isotropic turbulent viscosity fail to predict secondary flow phenomena during turbulent flow in fuel assembly channel. By solving Reynolds stresses transport equations, the more elaborate turbulence model, Reynolds stress model (RSM) can catch secondary flow accurately. The present studies provide valuable references and guidelines for further investigation on convective heat transfer simulation in complicated geometry and thermal hydraulic analysis of reactor core.

Key words [turbulence](#) [model](#) [complicated](#) [channel](#) [secondary](#) [flow](#) [numerical](#) [simulation](#)

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