反应堆工程

基于改进遗传算法的冷凝器优化设计

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摘要　　冷凝器是核动力装置二回路系统中的重要设备，它的重量和尺寸是影响核动力装置重量、体积及布置等的重要因素。本文利用传热经验关系式和冷凝器工业性试验结果，建立了冷凝器数学模型，该模型包括热平衡计算、阻力计算、振动校核和冷凝器重量、体积计算，编制了相应的程序来验证模型的精确性，并对冷凝器重量、体积受冷却管外径、节距和冷却水流速影响的敏感性进行了分析。利用改进遗传算法对冷凝器重量、体积进行优化设计，结果显示，与原方案相比，采用优化方案后冷凝器重量减小了6.926%，体积减小了12.587%，优化效果显著。

关键词

冷凝器　改进遗传算法　优化设计

分类号

Optimal Design of Condenser Based on Improved Genetic Algorithm

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Abstract The condenser is one of the most important equipments in nuclear power plant secondary loop, whose weight and dimension influence the weight, volume and arrangement of nuclear power plant. The mathematical model for condenser simulation was established by using empirical heat transfer formula and condenser industrial test results, which included thermal power balance calculation, resistance calculation, vibration analysis, condenser weight and condenser volume calculation. The corresponding computer code was programmed to verify the accuracy of the model. The sensitivities of cooling pipe outer diameter, cooling pipe pitch and the flow rate of cooling water, which influence the weight and volume of the condenser, were analyzed. The condenser weight and volume were optimized by improved genetic algorithm. The results show that condenser weight obtained with the optimal scheme is 6.926% less than the original, the volume is 12.587% less than the original, and the optimal effect is significant.

Key words　condenser　adaptive　genetic　algorithm　optimal　design

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