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反应堆工程

灵敏度分析方法在非能动系统可靠性研究中的应用

谢国锋[1]，童节娟[2]，郑艳华[2]

1.湘潭大学 材料与光电物理学院，湖南 湘潭 411105 2.清华大学 核能与新能源技术研究院，北京 100084

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摘要 在研究核电站安全时，热工水力非能动系统的可靠性研究基于所建立的热工水力学数值模型。模型通常极其复杂，具有多个输入参数，且输入参数具有不确定性，对模型输出的不确定性的影响又各不相同。灵敏度分析的目的是将各参数对模型输出的不确定性的影响进行排序，找出显著的影响参数。本文首先描述灵敏度分析的方法，然后应用秩转换回归分析方法计算HTR-10余热排出系统模型各参数的灵敏度，找出关键影响因素，将模型简化，并对简化模型应用响应面方法计算了失效概率。简化模型算得的失效概率与原模型的很接近。

关键词 非能动系统 可靠性 不确定性分析 灵敏度分析 蒙特卡罗模拟

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Application of Sensitivity Analysis in Reliability Research of Passive System

XIE Guo-feng[1], TONG Jie-juan[2], ZHENG Yan-hua[2]

1.Faculty of Material and Photoelectronic Physics, Xiangtan University, Xiangtan 411105, China; 2.Institute of Nuclear and New Energy Technology, Tsinghua University, Beijing 100084, China

Abstract In safety research of nuclear power plant, the reliability research of thermal hydraulic passive system bases on the numerical models. The models are always very complex. They have many input parameters with uncertainty. The influence of the parameters on the uncertainty of the model's output is quite different. The goal of the sensitivity analysis is ranking the parameters' influence on the uncertainty of the model's output and finding the key parameters. In the paper the methods of sensitivity analysis were described, the rank transformed regression method to analyze the parameters' sensitivity of the residual heat remove system model in HTR-10 was applied, and the key parameters were found and the model was simplified. Further more, the failure probability of the simplified model was calculated by surface response method. The result from the simplified model is very close to that from the original model.

Key words passive system reliability uncertainty analysis sensitivity analysis Monte-Carlo simulation

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