

国家重点基础研究项目

动态仿真中模型参数不确定性的定量分析

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摘要:

由于电力系统动态仿真模型中负荷参数存在不确定性, 这使仿真结果的可信度受到影响。在研究负荷参数不确定时, 采用传统蒙特卡罗分析法仿真次数过多、仿真时间过长, 而采用轨迹灵敏度法又不能给出参数不确定性影响的定量表示。因此采用了一种将轨迹灵敏度法与概率分配法相结合的方法, 定量分析负荷参数的不确定性对动态仿真结果的影响。在4机2区域系统上的仿真结果表明, 该方法不仅能够快速分析对仿真结果影响较大的主导参数, 而且能够直接输出响应与主导参数之间建立的最合适阶次的多项式关系, 定量分析参数的不确定性。因此文中方法能够快速清晰地量化出主导参数的不确定性与系统稳定度之间的关系。

关键词:

Quantitative Evaluation of Parameter Uncertainty in Dynamic Simulation Based on Trajectory Sensitivity and Probabilistic Collocation Method

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Abstract:

Confidence level of power system dynamic simulation results is affected due to the parameter uncertainty existing in the models for the simulation. In the research on parameter uncertainty, both simulation times and calculation amounts by traditional evaluation methods based on Monte Carlo analysis are not satisfied, and the quantitative expression of the influence of parameter uncertainty cannot be given by trajectory sensitivity, thus an approach combining trajectory sensitivity with probabilistic collocation is proposed to quantitatively analyze the influence of parameter uncertainty on dynamic simulation results. Results of dynamic simulation of a 4-machine 2-area system show that the proposed approach not only can rapidly analyze dominant parameters that greatly influence simulation result, but also can directly output a polynomial relation with the must suitable order that is built between dominant parameters and the response to quantitatively analyze the uncertainty of parameters. Thus, the proposed method can clearly quantize the relation between parameter uncertainty and system stability of power system.

Keywords:

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