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基于改进多信号Prony算法的低频振荡传递函数降阶辨识及PSS的设计

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摘要
为克服现代大规模电力系统分析的“维数灾”及电力电子元件难以用精确数学模型分析的问题，引入多信号到基于奇异值－总体最小二乘法的改进Prony算法中。在小波变换消噪和滤波的基础上，建立多信号的样本函数矩阵来提高辨识的准确性，在多信号的样本函数矩阵的基础上辨识振荡特征，并将计算结果应用到传递函数辨识中，然后依据辨识传递函数采用极点配置法进行电力系统稳定器(power system stabilizer，PSS)设计。IEEE 4机11节点系统验证了多信号改进算法对于信号特征和传递函数辨识结果的正确性和全面性，PSS加入实际仿真系统的效果说明了利用改进算法设计出的PSS效果优于利用传统线性化数学模型设计的PSS。

关键词 低频振荡；传递函数辨识；Prony算法；阻尼；电力系统稳定器

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Reduced Order Identification of Low-Frequency Oscillation Transfer Function and PSS Design Based on Improved Multi-Signal Prony Algorithm

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Abstract
To avoid the dimension disaster problem in modern large-scale power system analysis and overcome the difficulty of analyzing power electronic elements by accurate mathematical model, multi-signals are led into improved Prony algorithm based on singular values-total least square (SVD-TLS). Based on the denoising and filtering by wavelet transform, a multi-signal sample function matrix is built to improve the accuracy of identification; then based on multi-signal sample function matrix the characteristic of oscillation is identified; finally, the calculation result is applied in the identification of transfer function. According to the identified transfer function and by use of pole assignment, the power system stabilizer (PSS) is designed. The correctness and al-sidedness of identification results of signal characteristic and transfer function by improved multi-signal Prony algorithm are validated by IEEE 4-bus 11-machine system. When the designed PSS is added into simulation system, simulation results show that the performance of the PSS designed by the proposed algorithm is better than that of the PSS designed by traditional linearized mathematical model.

Key words low-frequency oscillations；transfer function identification；Prony method；damping；PSS

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