

电力系统运行与规划

含二次电压控制器最优协调电压控制的切换直接算法

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摘要: 基于准稳态假设, 提出保留二次电压控制器的动态最优协调电压控制模型。该模型旨在协调扰动后先导节点电压参考值和其他电压控制手段维护长期电压稳定。其目标函数考虑电压稳定和控制成本; 等式约束条件为连续-离散时间微分-代数方程组。采用拉道(Radau)排列法先对其进行离散化, 得到非线性规划(nonlinear programming, NLP)问题, 并基于内点法结合切换技术求解。该直接法具有数值稳定性好、计算速度快的特点。此外引入罚函数处理有载调压变压器变比等离散控制手段。在新英格兰39节点系统和IEEE 145节点系统上的试验证明了该模型及其算法的优势。

关键词: 长期电压稳定 二次电压控制 最优协调电压控制 直接法 离散控制 切换技术

OCVC Model Embedded With Secondary Voltage Controllers and Its Switching Direct Algorithm

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Abstract: Based on quasi-steady-state (QSS) approximation, an optimal coordinated voltage control (OCVC) model was proposed in which secondary voltage controllers were embedded. This model designed control strategies from dynamic view, and its control goal was to keep long-term voltage stability by coordinating the reference voltage of pilot buses and other control means. Its objective function considered voltage stability and control-costs, and its equality constraints were continuous and discrete time differential- algebraic equations. Radau collocation method was applied to discretize the original OCVC model and as a result, one corresponding nonlinear programming (NLP) problem was gained for which was solved on the basis of interior-point method and implemented by switching technique. This mentioned direct method had good numeric stability and low computation costs. To consider discrete characteristics of transformer tap changer etc., a penalty function was incorporated. Tests on New England 39-bus system and IEEE 145-bus system demonstrate the advantages of the method and its solution.

Keywords: long-term voltage stability secondary voltage control optimal coordinated voltage control direct method discrete control switching technique

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