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电力系统

高压配电网优化规划的研究

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摘要：

高压配电网是连接输电网和中压配电网的重要环节，其规划结果将影响城市供配电系统整体的经济性和可靠性；然而目前高压配电网规划与输电网规划之间缺乏协调，其规划模型和方法不够精细。针对该问题提出了改进的输电网与高压配电网协调规划的流程，建立了高压配电网优化规划的2阶段模型，综合考虑了220 kV变电站容量规划、110 kV高压配电网线路规划和负荷优化分区，可实现220 kV变电站、110 kV高压配电网线路扩建和网络损耗总费用的最小化。应用改进遗传算法求解该模型，在始终保持遗传算法中解的可行性前提下进行大规模寻优，提升了算法的全局搜索性能和收敛速度。针对某地区实际高压配电网络的规划结果验证了模型的合理性和算法的实用性。

关键词： 高压配电网规划 变电站扩容 协调优化 遗传算法

Studies on Optimal Planning of High Voltage Distribution Network

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Abstract:

High voltage (HV) distribution network is the key link connecting power transmission network and medium voltage distribution network, so the results of its planning have a great influence on overall economy and reliability of urban power supply and distribution system. However, at present there is lack of coordination between the planning of HV distribution network and the planning of power transmission network, and current planning model and method for HV distribution network is not perfect enough. Therefore, an improved mode to coordinate power transmission network planning with HV distribution network planning is proposed, and a two-stage model for optimal planning of HV distribution network is set up. To allow substation capacities to follow load growth, this model aims to achieve the optimal expansion of 220 kV substation capacity and 110 kV transmission lines as well as the optimal load partitioning, and to minimize the sum total of expansion investment of substations and transmission lines and operation cost mainly considering network loss. An improved Genetic Algorithm (GA) is developed to solve this complex model. The most important strategy of the algorithm is to keep the feasibility of the solution at all times by novel chromosome encoding and genetic operations, thus the global search performance and its convergence speed of the algorithm are enhanced. At last, the integrated planning model of transmission and distribution network is applied in an urban power grid. Results show that the proposed model is reasonable and the algorithm is feasible and effective.

Keywords: HV distribution planning substation capacity extension coordinated optimization genetic algorithm (GA)

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