

电力系统

自适应多目标差分进化算法在计及电压稳定性无功优化中的应用

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摘要:

计及电压稳定性的无功优化是一个兼顾降低有功网损和提高静态电压稳定性的非线性约束多目标优化问题, 提出一种自适应多目标差分进化算法(self-adaptive multiobjective differential evolution, SaMODE)对其进行求解。在差分进化的寻优机制中嵌入非劣排序和拥挤距离排序以对种群实施选择操作, 使算法快速收敛到Pareto前沿的同时, 保证了非劣解的均匀分布; 引入控制参数自适应调整策略, 避免对参数的反复试探, 提高了算法的鲁棒性。利用SaMODE对IEEE 30节点系统进行无功优化计算, 并与改进非劣排序遗传算法(nondominated sorting genetic algorithm II, NSGA-II)进行比较, 结果验证了所提算法的有效性和优越性。

关键词: 无功优化 电压稳定 多目标差分进化 自适应

A Self-Adaptive Multi-Objective Differential Evolution Algorithm for Reactive Power Optimization Considering Voltage Stability

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Abstract:

Reactive power optimization considering voltage stability is a nonlinear constrained multi-objective optimization problem, in which both reduction of active power loss and improvement of static voltage stability are considered. A self-adaptive multi-objective differential evolution (SAMODE) algorithm is proposed to solve the multi-objective reactive power optimization problem. The non-dominated sorting and crowded distance sorting are embedded into the searching mechanism of differential evolution to implement the selection operation, thus the uniform distribution of non-dominated solutions can be ensured and the algorithm can converge to the Pareto front rapidly; to improve the robustness of the algorithm, the self-adaptive adjusting control parameters is introduced into the algorithm to avoid the tedious process of choosing suitable control parameters. The reactive power optimization by the SAMODE algorithm is performed on IEEE 30-bus system, and the effectiveness and superiority of the proposed algorithm are verified by comparing the obtained simulation results with the calculation results of non-dominated sorting genetic algorithm II (NSGA-II).

Keywords: reactive power optimization voltage stability multi-objective differential evolution self-adaptive

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