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MPCG算法在GIS三相共罐式SF6高压断路器电场计算中的应用

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摘要
针对实际的GIS三相共罐式SF6高压断路器模型结构复杂的特点，分析了适用于计算多节点、多单元的大型稀疏正定实对称矩阵求解的修正预优共轭梯度算法MPCG，给出MPCG算法的迭代流程。根据系数矩阵稀疏、对称的特点，对系数矩阵的寻址方法进行了研究，引入了新的数据结构，该方法可以快速、有效地解决系数矩阵的寻址问题，占用内存少，寻址速度快。建立计算三维电场有限元模型及数理方程，根据该模型方程对高压断路器在工频测试电压下的电位和电场进行了计算，采用MPCG算法来求解所得到的大型有限元方程组。根据计算的电位和电场分布剖面图以及俯视图，可以为GIS断路器内部各部件的优化配置提供很好的参考。

关键词 修正预优共轭梯度算法 三相共罐式 高压断路器 有限元法 稀疏矩阵

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The Application of MPCG Algorithm in the Three Dimensional Electric Field Calculation of SF6 Circuit Breaker in Three-phase-in-one-tank GIS

Abstract
Based on the character of the complex structure of SF6 circuit breaker in three-phase-in-one-tank GIS, the modified preconditioned conjugate gradient(MPCG) algorithm applied to solve multi-nodes and multi-elements large sparse real positive defined symmetric matrix is analyzed and the program diagram of MPCG algorithm is also proposed. According to the sparse symmetric character of coefficient matrix, the method of storing coefficient matrix effectively and rapidly is studied and new data structure is adopted. The finite-element calculation model and physical equations of SF6 circuit breaker are founded The large sparse matrix is solved by using the MPCG algorithm. The electric field intensity and potential distribution are calculated under power frequency voltage and their corresponding profile charts and planforms are given. They can provide a useful and optimized design parameters for designing the circuit breaker configuration in GIS.

Key words modified preconditioned conjugate gradient three-phase-in-one-tank circuit breaker finite element simulation sparse matrix

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