

电机电工

1000kV立柱式氧化锌避雷器三维电位分布计算及均压环设计

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摘要

基于区域分裂思想,采用虚拟半球面耦合边界将三维上半空间无界域划分成耦合面内子区域与耦合面外无界子区域。其中,对耦合面内子区域采用传统有限元法离散;而将耦合面外无界子区域当作一个大单元,采用满足拉氏方程的本征解作为该大单元的插值函数,这样从根本上解决了有限元法难以离散无界场域的问题,从而形成了求解三维上半空间无界域静电场问题的一种新方法:有限元-解析结合解法。采用该方法对1000kV立柱式氧化锌避雷器三维电位分布进行了数值计算,讨论了影响电阻片电压承担率的多种因素。最后,给出了一种较为理想的均压环结构并得到了试验验证。

关键词 [避雷器](#) [电位分布](#) [有限元法](#) [解析法](#) [无界域](#) [静电场](#)

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3D Potential Distribution Calculation and Design of Grading Rings for Post-type ZnO Surge Arrester for 1000kV Substation

Abstract

Based on the idea of the region division, a half spherical fictitious boundary is employed to divide the 3D upper half free space unbounded region into an internal subregion and an external unbounded subregion. In the internal subregion the field is formulated by traditional finite element method. Meanwhile, the external unbounded subregion is treated as a big element on which the eigenfunction expressions satisfied the Laplace's equation with homogeneous boundary conditions at infinity are used as interpolation function and thus the difficulty in discretizing the infinite region for FEM is overcome radically. Moreover, a new approach called hybrid finite element-analytical approach to compute 3D upper half free space unbounded electrostatic problems is formed. The new approach is used to compute the 3D potential distribution of a post-type ZnO surge arrester for 1000kV substation. Factors affecting block voltage ratio have been studied. Finally, the appropriate configuration parameters of grading rings are suggested and a good agreement was found between the computed and measured block voltage ratio.

Key words [surge arrester](#) [potential distribution](#) [finite element method](#) [analytical solution](#) [unbounded region](#) [electrostatic problems](#)

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