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电工理论与新技术

永磁导轨悬浮和导向磁力研究

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摘要： 为了寻求永磁悬浮导轨磁力的简便算法，基于由磁荷法和虚位移法给出的永磁磁力数值积分公式，结合两块平行矩形截面永磁体及永磁导轨结构特点，推导出永磁悬浮导轨解析磁力模型；根据介质分界面为平面的电流镜像法，得到了永磁体在铁磁体中的镜像，分析了永磁导轨的悬浮磁力和导向磁力。模型分析表明：两块截面平行永磁体的磁力分别与永磁体剩磁的平方和永磁体的纵向长度成正比，磁力随永磁体的横截面增大而增大，随永磁体的间距增大而减小；永磁导轨悬浮磁力随永磁导轨倾斜度增大而减小，导向磁力随永磁导轨倾斜度增大而增大。该模型通过代数运算就可得到精度较高的磁力计算结果。经验证，模型计算值和实验值吻合。

关键词： 永磁导轨 永磁体镜像 悬浮磁力 导向磁力 解析模型

Research on the Levitation and Guidance Magnetic Force of Permanent Magnetic Guideway

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Abstract: To seek the simple calculation method for permanent magnetic guideway (PMG) magnetic force, based on PM (permanent magnet) magnetic force numeral-integral formula which is derived from equivalent magnetic charge method and virtual displacement method, the analytical magnetic force model of PMG was constructed according to the structure character of two parallel rectangle-section PM and PMG. Based on Current Image Method, the virtual image of PM in magnetizer was obtained. PMG levitation and guidance magnetic force were also analyzed. The analysis on such model shows that the magnetic force of two parallel rectangle-section permanent magnets is proportional to the square of residual magnetism induction density and PM longitudinal length. It also shows that the magnetic force increases with the increment of PM cross section and decreases with the increment of gap between two permanent magnets; while that PMG levitation magnetic force decreases with the increment of PMG obliquity and guidance magnetic force increases with the increment of PMG obliquity. More precise calculation results of magnetic force can be achieved by algebra calculation. The calculated values are basically in accordance with those measured.

Keywords: permanent magnetic guideway virtual image of permanent magnet levitation magnetic force guidance magnetic force analytical model

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