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行波磁场驱动的磁力传动系统空间磁场数学模型

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摘要: 为提高大间隙、高转速条件下磁力传动系统的可靠性, 提出行波磁场驱动的大间隙磁力传动技术, 研究磁力传动系统空间数学模型。首先, 分析系统主动磁极(电磁体)磁极状态和从动磁极(永磁体)转动状态之间的关系, 确定驱动永磁体转动的电磁体4个磁极状态及切换顺序; 其次, 基于磁路基本原理, 通过磁场分析和建模, 以电磁体4个磁极状态之一的NS(N表示其左极、S为右极)为例, 对电磁体的空间磁场分布进行研究并建立空间磁场数学模型; 最后, 以MATLAB为平台对4个磁极状态的空间磁场数学模型进行求解, 将求解结果与实验数据进行对比。研究表明, 电磁体空间磁场数学模型是正确的。

关键字: 行波磁场; 磁力传动; 空间磁场; 数学模型

Space magnetic field's mathematical model of magnetic drive system driven by traveling wave magnetic field

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Abstract: In order to improve the magnetic drive system's reliability under the condition of large gap and high speed, the large gap magnetic drive technology, which is driven by traveling wave magnetic field, was brought forward. The space magnetic field's mathematical model of magnetic drive system was studied. Firstly, the relationship between the magnetic pole state of active magnetic pole (electromagnet) and the running state of passive magnetic pole (permanent magnet) was analyzed. The electromagnet's four magnetic pole state and switch sequence, which can drive permanent magnet rotate, were ascertained. Secondly, taking one of magnetic pole state NS (N denotes electromagnet's left magnetic pole and S right magnetic pole) as an example, the distribution of space magnetic field was studied. In addition, the mathematical model of space magnetic field was set up based on the magnetic circuit fundamental and using the method of magnetic analysis and modeling. Lastly, the four states' mathematical model of space magnetic field was solved by using the MATLAB. After the solving result and experiment data were compared, the results show that the space magnetic field's mathematical model is correct.

Key words: traveling wave magnetic field; magnetic drive; space magnetic field; mathematical model

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