电机与电器

永磁轮毂电机齿槽转矩研究

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摘要：　针对永磁电机中非理想因素对齿槽转矩的影响，基于能量法和傅里叶级数解析方法给出了齿槽转矩的一般表达形式，并分析了理想及非理想条件下齿槽转矩的谐波成分。对一台12槽10极内置径向式永磁同步轮毂电机，应用有限元分析方法研究其在理想条件下以及存在定子椭圆和永磁体偏移的条件下的齿槽转矩。研究结果表明，在非理想条件下齿槽转矩发生明显改变，其中定子椭圆引起的低次谐波影响最大。提出了一种由步进电机、转矩传感器等元件组成的齿槽转矩测试系统。对样机的齿槽转矩进行实验研究，实验结果与计算结果趋势一致，表明了理论分析的正确性。

关键词：　齿槽转矩　永磁轮毂电机　非理想因素　定子椭圆

Study on Cogging Torque of Permanent Magnet In-wheel Motor

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Abstract: The non-ideal factors of permanent magnet motor have great influences on its cogging torque. Based on the energy method and Fourier series expansion the general expression of cogging torque was obtained and the harmonic components of cogging torques were analyzed under both ideal and non-ideal conditions. Furthermore, the cogging torque of an interior permanent magnet in-wheel motor with 12 slots and 10 poles was investigated using finite element method under three conditions of ideal condition, elliptical stator existed and magnet offset respectively. The results indicate that the cogging torque has changed obviously under non-ideal conditions and the low-order harmonic caused by the elliptical stator has the most important effect on it. A cogging torque measurement system was proposed, which was composed of stepping motor, torque sensor, etc. The experiments on the cogging torque of the prototype motor were conducted, the experimental results are in agreement with the calculated results and the validity of the theoretical analysis was verified.

Keywords: cogging torque　permanent magnet in-wheel motor　non-ideal factors　elliptical stator

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