电机与电器

行波型超声波电机的温度特性

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摘要
为解决行波型超声波电机运行中温升和发热严重问题，提出一种基于能量耗散的超声波电机表面温度特性理论模型。利用电机定子复合结构的振动耗散能、压电陶瓷的介电耗散能以及定、转子接触面的摩擦损耗能确定电机的总体能量损耗，采用自然对流传热问题的牛顿冷却定律和热容理论，建立超声波电机的表面温度特性理论模型；仿真分析电机结构和材料参数(包括驱动电压、驱动频率、预压力、摩擦材料特性以及负载力矩等)对电机表面温度特性的影响；通过实验研究温度对电机输出特性、谐振频率的影响。最后通过实验验证了该模型的有效性和正确性。

关键词　　超声波电机　温度特性　能量耗散　仿真　实验

分类号　　TM 35

Temperature Performance Study of Traveling-wave Type Ultrasonic Motor

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Abstract
In order to solve the rapid temperature rising and heavy heat generating problems during the operation of the traveling-wave type ultrasonic motor(TWUSM), an energy dissipation-based theoretical model of the surface temperature performance of TWUSM was proposed. In this model, the general energy dissipation of TWUSM is composed of the stator composite structure vibration loss energy, the dielectric loss energy of the piezoelectric ceramic and the friction loss between the stator and the rotor. The surface temperature theoretical model of TWUSM was derived by Newton cooling law and heat capacity theory. Simulations were done to study the effects of the structural and material parameters on the temperature performance. Then the influences of the temperature on the resonant frequency and the mechanical performances of TWUSM were researched by experiments. The validity and the availability of the model are verified by experiments.

Key words　ultrasonic motor　temperature performance　energy dissipation simulation calculation　experiment

DOI：

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