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计量测试

# 光栅扭矩动态测量系统设计及实现

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摘要　机械主轴在各种载荷和工作环境下的扭矩测量，国内外一直没有比较好的解决方案。针对这一现状，提出通过在主轴2端安装圆光栅及指示光栅，采用对光栅莫尔条纹计数及细分的方法实现主轴扭矩非接触式动态直接测量。其方法是在将莫尔条纹进行光电转换后，采用集成可编程模拟器件对信号进行放大、滤波和比较，然后利用软核微处理器实现数据采集、处理和控制，从而取代FPGA＋MCU的方式。实验中，测量系统采用1200条刻线的圆光栅，在主轴转速为0～1500r/min的范围内测量其扭矩，扭转角精度小于0.001°。实验结果表明，采用圆光栅莫尔条纹可以达到主轴扭矩高精度测量的要求，为机械主轴测量提供了一种新的非接触式测量方法。

关键词　扭矩测量　Nios软核　相位差细分　光栅

分类号

## Implementation and design of dynamic measurement system of grating torque

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**Abstract**

There is no good solution to the torque measurement of mechanic principal axes working under various loads at home and abroad. Through installing the circular grating and indicative grating at both ends of a principal axis, the non　contact dynamic measurement of the principal axis torque can be realized by computing and sub　dividing grating Moiré fringes. After the photoelectric conversion of the Moiré fringes, the signal is amplified, filtered and compared with integrated programmable analog devices. Here, a microprocessor of soft core is used to realize data acquisition, processing and controlling, and to substitute the method of FPGA+MCU. During the experiment, the circular grating with 1200 grating lines was adopted, and the precision of the twist angle (less than 0.001°) was acquired while the rotational speed of the principal axis is within the range of 0～1500r/min. The experiment shows that the adoption of Moiré fringes of the circular grating can make high　precision torque measurement of the principal axis meet the requirement, which offers a new non　contact method for the measurement of mechanic principal axes.

**Key words**　torque measurement　Nios soft core　sub　division of phase difference　grating

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