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ACSM法系统设计及铁磁构件应力测量研究

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摘　要：

大型机械装备关键部件工况恶劣，易产生应力集中并导致发展为宏观缺陷。设计开发一套交变应力测量系统，系统包括测量传感器、DDS信号激励模块、信号调理模块、信号采集与处理模块。基于电磁理论设计优化U型磁轭传感器，依据互相关原理设计信号调理模块，并利用该系统对受载Q235钢进行应力测试。实验结果表明，ΔBx参量随激励电压有显著变化，当激励电压为5V时，ΔBx变化较小，构件屈服后仅有10mv变化，激励电压为19V且载荷为300MPa时ΔBx达到98mv。构件在弹性阶段ΔBx与应力呈线性变化，屈服后迅速增大；ΔBz变化较小且规律复杂，不适宜对应力进行评估。结果表明该系统为铁磁构件的应力测量提供了一种有效的测试方法。

关键词：无损检测；应力测量；交变应力测量法；U型磁轭传感器；铁磁构件；

The System Design of ACSM and Research of Stress Measurement on Ferromagnetic Components

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Abstract:

The key parts of large machinery are most worked in poor conditions, which is easy to produce stress concentration and lead to macroscopic defects. An alternating current stress measurement (ACSM) system is designed, which includes measuring sensor, DDS signal generator module, signal adjusting module, signal acquisition and processing module. The U-shaped sensor is optimized based on electromagnetic theory. According to the principle of correlation, signal adjusting module is devised. The stress measurement experiments of loading Q235 steel are carried out by the system, the laws are presented in the test, which show that ΔBx has significant change with excitation voltage, the maximum of ΔBx is only 10mv when voltage value is 5V, but ΔBx can reach 98mv when voltage value is 19V and load is 300Mpa .ΔBx has linear variation with stress in the elastic stage and increases rapidly over yield point, the change of ΔBz is small and complicated, so the ΔBz is unfit for stress assessment. The results show that an effective method for stress measurement on ferromagnetic structure is provided by the system.

Keywords: nondestructive testing; stress measurement; alternating current stress measurement; U-shaped sensor; ferromagnetic structure;

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