基于光纤微弯传感器的汽车动态称重系统设计

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摘　要：

为解决目前汽车动态称重过程中存在的电磁干扰和精确度低的问题，在分析光纤微弯传感器测量原理的基础上，提出了一种基于光纤微弯传感器的汽车动态称重系统。压力的变化引起传感光纤发生弯曲变形，产生输出损耗，通过测量输出光强的变化实现汽车重量的动态称量；设计相应的光电转换和采样放大电路，并采用小波变换对采样信号进行去噪处理。对光纤传感系统的静态响应特性进行验证表明:在0-3000Kg的范围内光纤传感系统具有良好的线性响应特性，灵敏度为3.8mV/Kg；动态响应实验表明：当汽车通过速度小于15Km/h时，光纤微弯动态称重系统的测量误差小于5.4%,能够满足动态称重的需要。

关键词：动态称重; 微弯; 光纤传感器; 轴重仪; 小波变换

Design of Vehicle Weight-In-Motion System Based on the Fiber-optic Micro-bend Sensor

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Abstract:

In order to resolve the problem of electromagnetic disturbance and low precision in vehicle weight-in-motion (WIM) system, a vehicle weight-in-motion system based on fiber-optic micro-bend sensor is proposed on the analysis of its working principle. The pressure on sensor cause the optical fiber deformed, which lead to the loss of output light, so the vehicle weight can be obtained through measuring the variation of light intensity in optical fiber. Photoelectric conversion and sampling circuits are designed, and wavelet transform is adopted to de-noise the sampled signal simultaneously. Static response experiments show that the fiber-optic micro-bend sensor has fine linear response to the pressure in the scope of 0-3000Kg, and its sensitivity is 3.8mV/Kg. Dynamic response experiments indicate that the measurement error of fiber-optic micro-bend weight-in-motion system is less than 5.4% when the vehicle velocity is under 15Km/h, which meet the requirement of vehicle weight-in-motion system very well.

Keywords: weigh-in-motion(WIM); micro-bend; fiber-optic sensor; axle weight scale; wavelet transform

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