沥青混合料含水量集成检测系统设计与研究

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摘　要：

为提高路面沥青混合料含水量测量装置精度,简化结构，提出一种1.5GHz微带环结构的含水量传感器检测系统。因含水量不同，不饱和混合料介电常数变化，导致微带环有效介电常数发生改变，谐振频率偏移。通过谐振频率反演混合料介电常数，建立含水量与有效介电常数的线性关系求得沥青混合料含水量。研究工作包括算法分析、微带环结构设计仿真、系统软硬件集成设计。混合料样本(含水量0-30%)测试显示测量分辨率≤0.1%,误差≤1%,系统响应时间≤100ns。这种新型传感器体积小、功耗低、精度高，适合路面测量。

关键词：沥青混合料；含水量检测；微带环传感器；介电常数；谐振频率；

Design of Integrated System for Sensing Moisture Content of Asphalt Mixture

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Abstract:

To improve the accuracy of the sensor measuring pavement asphalt mixture moisture, and simplify its structure, A 1.5 GHz micro-ring resonator is presented in the paper. With different water content, the dielectric constant of unsaturated asphalt mixture changes within a range, which causes effective dielectric constant of micro-ring changed and micro-ring resonant frequency shifted. To invert the mixture dielectric through the resonant frequency, and build the linear-proportion between water content and effective dielectric constant, water content in asphalt mixture can be got. The research work includes algorithm analysis, micro-ring structure design and simulation, and sensor integration design. Mixture sample(water content in 0-30%)tests show that the measurement resolution≤0.1%, the measurement error≤1%, the system response time ≤100ns. This new sensor is small volume, low power consumption, high precision, suitable for pavement detection.

Keywords: asphalt mixture; moisture content detection; micro-ring sensor; dielectric constant; resonant frequency;

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