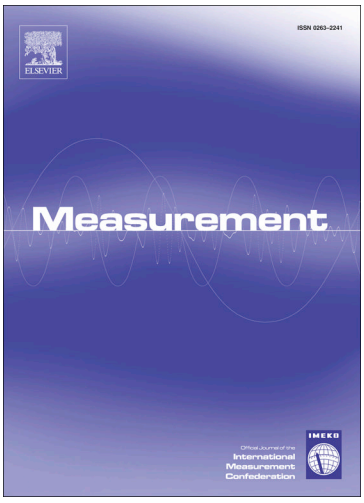

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A new approach for damage detection in asphalt concrete pavements using battery-free wireless sensors with non-constant injection rates

Hassene Hasni[1*], Amir H. Alavi[1], Pengcheng Jiao[1], Nizar Lajnef[1], Karim Chatti[1], Kenji Aono[2], Shantanu Chakrabartty[2]

[1]*Department of Civil and Environmental Engineering, Michigan State University, East Lansing, MI 48824, USA*

[2]*Department of Computer Science & Engineering, Washington University, Saint Louis, MO 63130, USA*

Abstract

This study presents a novel approach for detection of bottom-up cracking in asphalt concrete (AC) pavements using self-powered wireless sensor (SWS) with non-constant injection rates. The performance of the sensors was evaluated through numerical and experimental studies on an asphalt concrete specimen under three-point bending configuration. Damage was introduced by making notches with different sizes at the bottom of the specimen. Different 3D finite element (FE) models were developed using ABAQUS to generate the sensor output data for different damage states. Thereafter, the laboratory tests were carried on the same specimen to validate the performance of the proposed damage detection approach. Polyvinylidene fluoride (PVDF) piezoelectric film was used to harvest the strain energy from the host structure and empower the sensor. In order to protect the embedded sensor, an H-shape packaging system was designed and tested. The results indicate that the progression of bottom-up cracks can be accurately detected using the proposed self-powered sensing system.

Keywords: Self-powered wireless sensor, Non-constant injection rate, Finite element modeling, Polyvinylidene fluoride, Damage detection.

* Corresponding author. Tel.: +1 (517) 505-0367
Email addresses: hasniha1@msu.edu (H. Hasni), ah_alavi@hotmail.com; alavi@msu.edu (A.H. Alavi)