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Load identification and damage evaluation of a beams ubjected to moving loads by using co-located strain and acceleration measurements

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ABSTRACT

Bridge structural health monitoring and assessment are important subjects nowadays. In this paper, we propose a novel method which allows to evaluate both the bridge structural health and its loads based on strains and accelerations measured at the same location. The bridge is considered as governed by the Euler-Bernoulli beam equation. The strain can be obtained directly from sensors such as fiber optics. This type of sensors has many advantages such as high precision, high sampling frequency, durability… so that the dynamic strain component can be acquired easily. By decomposing the obtained signals into static and dynamic components, the correlation between strain and acceleration for the same type of component is clarified. The proportional coefficients, which reflect the intrinsic state of the beam and its load, can be obtained by optimization. From the variation of these coefficients, information on the damage of the bridge can be obtained. Moreover, in case of multiple loads (multi-axle vehicle), the distance between the axles of the vehicle can also be determined. Numerical results with several scenarios will be presented to demonstrate the efficiency and the robustness of the method.

Keywords: Damaged Identification, Moving Load, Bridge, Strain, Acceleration.

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