

## **FIR Filter Based Bridge Displacement Estimation Using Strain and Acceleration Measurements**

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### **Abstract**

In this study, a finite impulse response (FIR) filter-based displacement estimation technique is proposed for bridge monitoring by fusing strain gauge and accelerometer measurements. First, the relationship between displacement and strain is established, and the parameter associated with this strain–displacement transformation is estimated from the strain and acceleration measurements using a recursive least squares algorithm. Next, the low-frequency displacement estimated from the strain measurements and high-frequency displacement obtained from an acceleration measurement are combined using a FIR filter for high-fidelity displacement estimation. The feasibility of the proposed technique was examined via numerical simulations of beam models and a real bridge model.

**Keywords:** Displacement estimation, FIR filter, Neutral axis location, Strain gauge, Accelerometer

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