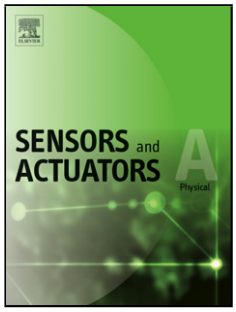

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Multi-axis dynamic displacement measurement based on a strain shunt structure

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Highlights

- An innovative multi-axis displacement sensor is proposed;
- The sensor has advantages of low-cost, low power consumption, fast response;
- Sensitivity is derived analytically from key geometrical parameters;
- The linearity of strain measurement to displacement has been experimentally validated;
- Sensor structure and gauge position are optimised by finite element analysis.

Abstract:

Transient gap or crack width monitoring is essential for structural health monitoring and failure analysis of large civil structures. In this paper, an innovative multi-axis displacement sensor, which utilises metal foil strain gauges on a strain shunt structure, has been proposed. This displacement sensor has the advantages inherited from metal foil strain sensing, such as low cost, high precision, fast dynamic response and low power consumption, and can also measure displacement in two axes independently. The working principles and sensitivity are derived theoretically from key geometrical parameters of the shunt structure, and the linear response of strain values to the given displacement of two translational axes has been demonstrated experimentally. Furthermore, modal response, stress concentration, optimal gauges installation positions and bending deformation due to moment of the third axis are studied numerically.