Curvature vector smart sensing with a long-period fibre grating probed by artificial intelligence

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Abstract

This work shows a curvature vector sensing device based on a single long-period grating written in a commercial photosensitive optical fibre. The sensing approach uses an artificial neural network based on multilayer perceptrons for data analysis. Curvatures from 0.00 to 3.13 m^{-1} and angular orientations from 0 to 180° were measured with the device, with combined standard uncertainties of 0.05 m^{-1} and 1.5°, respectively. The root mean square errors for curvature and angular orientation were 0.0008 m^{-1} and 0.3° in the training stage and 0.002 m^{-1} and 0.9° in the test stage, respectively.

Keywords: long-period grating, curvature vector measurement, optical bend sensor, artificial neural network