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

R Z V Costa, G R C Possetti, L V R de Arruda, M Muller and J L Fabris
Universidade Tecnológica Federal do Paraná, Av. Sete de Setembro 3165, Curitiba, PR, Brazil 80230-901
E-mail: fabris@ufpr.edu.br
Received 20 December 2009, in final form 1 April 2010
Published 28 July 2010
Online at stacks.iop.org/MST/21/094027

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