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Linear strain sensing performance of continuous high strength carbon fibre reinforced polymer composites

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Abstract: A feasible method of pre-tension was proposed to improve the sensing performances of carbon fibre reinforced polymer (CFRP) composites through reducing the misalignment and winding of carbon fibres. The CFRP composites consisted of high strength carbon fibres as active elements, epoxy resin as a matrix and sensing electrodes. Firstly, the sensing model was established based on the conductivity analysis of the CFRP composites. Then, a series of experiments were carried out to study the strain sensing linearity and stability under cyclic loading. The experiments showed that the linearity of the CFRP composites increases with increasing pre-tension amplitudes, and that a stable and linear sensing behavior can be obtained when the pre-tension amplitude is larger than 200με. The $\Delta R/R_0$-strain curves can be linearly fitted with a correlation coefficient larger than 0.985. It was revealed that the loading manner also has some influence on the sensing behavior of the CFRP composite sensors. The gauge factors for an intermittent cyclic loading (range: 2.85-3.37) are larger than those for a continuous cyclic loading (range:

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