Strain Profile with Distributed Brillouin Sensor: A Step Toward Anticipative Detection of Local Degradation of Structures

Distributed sensors based on Brillouin scattering are attractive candidates to monitor structural health of linear structures such as pipelines and beams. These sensors measure strain due to local deformations such as buckling, and, at the same time, allow real-time control over lengths ranging from meters to tenths of kilometres.

We conducted an experiment reproducing the buckling of a one meter long steel beam. Its inner wall was intentionally thinned at 40cm from the beginning of the specimen. The thinned section length was 10cm. An optical fibre was laid along the external wall. Strain gauges were glued in the thinned wall area. An axial load was applied until the buckling arouse. Simultaneously strain measurements were carried out Brillouin sensor and strain gauges. Both techniques show that compression follows the load increase with a dip in the strain profile corresponding to the induced weakness. The dip deepening started to be unambiguously observed for a load of 780kN. The buckling happened after the 890kN load and was monitored with Brillouin sensor system

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