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Mixed numerical–experimental identification of elastic properties of orthotropic metal plates

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Abstract

This paper compares results of three different methods to determine the in-plane elastic properties of sheet materials. Results obtained with standard resonant beam and tensile tests are used to assess a mixed numerical–experimental technique developed to determine the in-plane elastic properties of orthotropic plates from the resonance frequencies of rectangular plate samples (the so-called 'Resonalyser' technique). Test materials were selected on the basis of an expected low degree of elastic anisotropy in order to put the accuracy and sensitivity of the different techniques to assess anisotropic materials to a test. Therefore, aluminium alloy and stainless steel samples were prepared from hot-rolled plates, deliberately avoiding pronounced cold-rolling textures. The differences between the results obtained with the three experimental approaches are critically evaluated.

In the case of very thin plates, the existing mixed numerical–experimental Resonalyser procedure succeeded in accurately identifying the elastic material properties. A slightly adapted procedure is proposed to extend the applicability of the Resonalyser procedure to thicker plates.

Keywords: Material identification; Elastic properties; Vibration testing methods