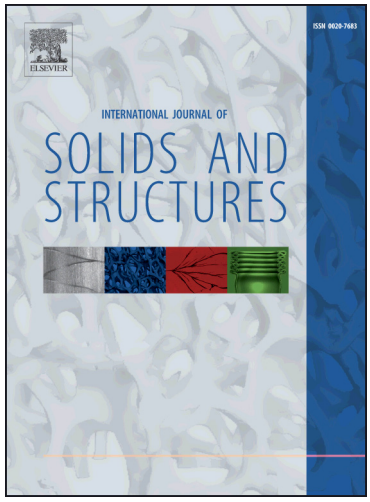

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Multi-scale method for modeling thin sheet buckling under residual stresses in the context of strip rolling

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Abstract

In cold strip rolling, the transverse gradient of thickness strain results in heterogeneous longitudinal stress σ_{xx}. Whenever the latter is compressive in spite of strip tensions, an on-line manifested flatness defect may occur. It is of interest to determine the occurrence and geometric characteristics of such defects. To do this, a two-scale model based on the generalized continuum approach of (Damil and Potier-Ferry, 2006, 2008) is applied to this problem. It consists in developing the unknowns (in plane stress components and out-of-plane displacement) in Fourier series and solving von Karman equations of thin strip buckling, in an energetic formulation. For application to cold rolling, certain simplifications are made and commented. The potential of this method is analyzed using simple assumed stress fields via (i) parametric studies and (ii) comparison with other available studies: a semi-analytical solution and a more general FEM solution of sheet buckling by the Asymptotic-Numerical Method (ANM).

Keywords

Thin sheet – Multiscale generalized continuum method – Buckling – Post-buckling