Buckling analysis of beam-like structures

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Abstract

In this paper, an homogenized beam model is formulated for buckling analysis of periodic micro-structured beams, uniformly compressed. These are planar grid beams, whose micro-structure consists of a square lattice of equal fibers. The equivalent beam model is derived in the framework of a direct one-dimensional approach and its constitutive law, including the effect of prestress of the longitudinal fibers, is derived through a homogenization approach. Accordingly, micro–macro constitutive relations are obtained through an energy equivalence between a cell of the periodic structure and a segment of the homogenized beam. The model also accounts for micro-warping of the micro-structure, via the introduction of elastic and geometric corrective factors of the constitutive coefficients. The buckling behavior of sample grid beams is presented to validate the effectiveness and limits of the equivalent model. To this purpose, results supplied by the exact analyses of the equivalent beam are compared with those given by finite element models of the planar grid beams.

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