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Determination of Stresses in Vlasov Beam Sections

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Abstract : In this paper, the normal and shear stress distributions in Vlasov beams are determined by two-dimensional triangular finite element formulations. The proposed formulations take into account the warping effects along the beam axis. The shape of the considered beam sections may be arbitrary and varied throughout its length. The stiffness matrices and force vectors are derived for transversal forces, uniform torsion, and nonuniform torsion. The proposed finite element algorithm is validated by comparing the analytical solutions, structural engineering books, and related articles. The numerical examples include beams with different cross-section types such as solid, thick-walled, closed-thin-walled, and open-thin-walled sections. Materials defined in the examples are homogeneous, isotropic, and linearly elastic. Through these examples, the study demonstrates the capability of the proposed method to address a wide range of practical engineering scenarios.

Keywords : Vlasov beams, warping function, nonuniform torsion, finite element method, normal and shear stresses, cross-section properties
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