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FINITE DEFORMATION ANALYSIS OF A PRESTRESSED ELASTIC BEAM AFTER THE LAYER ADDITION

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An approach to the numerical modeling of stress state in a two-layered beam is developed for finite deformations. It is assumed that the first layer of the beam is preliminarily stressed, and then the second layer is added. The problem is formulated and solved using the theory of repeatedly superimposed finite strains. The spectral element method is used for the analysis. The spectral elements of variable order are used on non-conformal unstructured meshes. The computations are performed for the case of plane strain. It is assumed that the beam is made of the weakly compressible Mooney-Rivlin material. The incomplete junction of layers is considered. The numerical results are given for the case in which the first layer is preliminarily stretched along its axis. It is analyzed how the curvature of the beam after the junction of layers depends on the value of preliminary stretch. It is shown that this dependence is not monotone. The stress distribution in the composite beam is shown for a particular case.

The proposed approach can be useful for the modeling of additive manufacturing. In this case the preliminary strains and stresses in the first layer are caused by thermal effects.

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