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SOME EFFECTS OF DEFORMATION OF LAMINATED MEDIUM

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There are discussed two effects arising as results of homogenization of the elasticity problem for laminated materials found by the authors:

- transformation of nonlinearity of deformation into material nonlinearity;
- singularity of solution in composite with „laminated-circular“ microstructure subjected to antiplane deformation.

The first problem deals with a laminated composite under nonlinear deformations under condition the strain–stress relationship is given by linear (Hooke’s) law. It is found that [1, 2] that the homogenized problem (i. e. material „in whole“) corresponds to material with a nonlinear strain–stress relationship. It is also found that, generally, the local stresses in the laminae are not proportional to the stiffness of the laminae if the deformation of the composite is not linear. This observation is important for correct prediction of the strength of composite material because often (by analogy with the linear case) the local stresses in laminated composite are assumed to be proportional to the stiffness of the laminae. The effects found clear manifest themselves starting at strains about 2%. It means that the zone of action of the effects found joints directly to the zone of linear (small) deformations.

The second problem deals with a composite with „laminated–circular“ microstructure (the laminae are curved as coaxial cylinders or as logarithmic spiral cylinders) subjected to antilpane deformation (in the direction of the axis of the cylinders). It is found that solution of the homogenized problem can have a singularity in the origin. The existence or absence of the singularity depends on the material and geometrical properties of the laminae.

REFERENCES

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