

COMPUTER MODELING OF NATURAL VIBRATIONS OF COMPOSITE PANELS WITH DELAMINATIONS

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Abstract: The effect of delaminations on natural frequencies and vibration shapes of composite panels has been investigated. The finite element method was used for computer modeling.

Key words: composite, natural frequency, modeling

An important problem of ensuring the reliability and safety of panels made of carbon fiber-reinforced plastic (CFRP) is related to the possible appearance of delaminations in them as a result of an impact [1, p. 456]. This can be the result of a falling tool, bird strike, etc. [2, p. 506]. In addition, during operation, experience has been gained in detecting microcracks in aluminum panels: these cracks are located in rivet joints, near holes, in welding points, and they can be observed visually or with the help of brittle coatings [3, p. 47].

Delaminations in CFRPs introduce distortions in the local stress and strain fields, and therefore they can affect the natural shapes and frequencies of vibrations. To investigate such effects, computer modeling of delaminations was carried out by applying special finite elements with broken transverse bonds. These methods allow modeling the growth of delaminations as well as estimating the shapes of vibrations. Similar computer calculations up to high vibration forms have shown that delaminations noticeably affect the local shape of the displacement field under forced vibration, but practically do not affect the frequency of natural vibrations, since this is an integral characteristic that does not depend on local perturbations.

References

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