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On the vibrations of a composite structure with hexagonal structure of a circular inclusions

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Abstract: One of the major advantages of homogenization is a possibility of the generalization of the obtained results. Namely, if a solution to the local problem is found, then without principal problems one may solve not only the analyzed problem, by also a series of related static and dynamic problems, including: linear, quasi-linear, the eigenvalue problems, etc. The mentioned approach has been applied to the eigenvalue problems regarding the perforated structures and periodically non-homogenous 2D constructions with a square mesh of inclusions. In this work we have used theory of averaging to solve the vibrations problem regarding stiffly clamped rectangular membrane with periodically located circular inclusions creating a hexagonal mesh. The relations governing eigenvalues (frequencies) and eigenfunctions have been derived. The derivation of analytical formulas governing membrane eigenforms and frequencies consists of three parts. In the first part the local problem regarding a cell (inclusion) of the composite is studied. Second part is focused on finding main terms of the averaged problem. The third part is aimed at an estimation of the first improvement term with respect to the membrane fundamental frequency. In addition, the theory of averaging has been applied in order to solve the problem of vibrations of the rectangular membrane stiffly clamped along its contour, representing the composite structure with periodically located circular inclusions within the hexagonal mesh.

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