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On Asymptotic Method of Static and Dynamic Boundary Problems Solution

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The equations of elasticity theory for thin bodies (bars, beams, plates, shells) are singularly perturbed by small geometric parameter. For the solution of such systems an asymptotic method is suggested to be used. The solution of the corresponding boundary problem of elasticity theory consists of two qualitatively different types of solutions – inner problem and boundary layer. The ways of constructing these solutions and their conjunctions are described. We consider as classic boundary problems as well as nonclassic boundary problems from the point of view of the plates and shells theory on the facial surfaces the displacement vector components or mixed conditions are given. Asymptotics of the inner problem solution is established, it is proved that it sensitively reacts on the type of the boundary problems conditions of elasticity theory laid on the facial surfaces. Solutions of the boundary layers are constructed. The relation of the boundary layer with Saint-Venant principle is displaced. In case of the first boundary problem for a rectangle it is proved that Saint-Venant principle is mathematically exact. Iteration processes for the determination of the inner problem solution are built, the connection with the solutions on classical Bernoulli-Coulomb theory of beams, Kirchhoff-Love theory of plates and shells with precise theories on the base of softened hypothesis is established. The formula of calculation of the bed coefficient for a layered foundation is reduced. The asymptotic method is especially effective for the solution of nonclassical dynamic boundary problems. Free and forced vibrations of thin bodies are considered. The connections between the frequencies values of free vibrations and the velocities of propagation of elastic shear and longitudinal waves are established.

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