BOUNDARY VALUE PROBLEMS OF THERMOELASTIC RODS DYNAMICS AND THEIR GENERALIZED SOLUTIONS

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Abstract

Rod structures are widely used in mechanical engineering as connecting and transmission links for structural elements of a wide variety of machines and mechanisms. During operation, they are subject-ed to variable mechanical and thermal influences, which create a complex stress-strain state in structur-al elements, depending on their temperature, and affecting their strength and reliability. Therefore, the determination of the thermally stressed state of rod structures, taking into account their mechanical properties (in particular, elasticity and thermal conductivity) is one of the topical scientific and tech-nical problems. Here, spatially one-dimensional unsteady boundary value problems (BVPs) of uncoupled ther-moelasticity are considered, which can be used to study various bar structures. This model describes well thermodynamic processes at low strain rates and here a unified technique is proposed for solving various BVPs typical of practical applications. Problems of determining the thermally stressed state of a thermoelastic rod using a model of uncoupled thermoelasticity are considered. Generalized solutions of non-stationary and stationary direct and semi-inverse BVPs under the action of power and heat sources of various types are con-structed on the basis of the method of generalized functions. Acting sources can also be specified by singular generalized functions, under different boundary conditions at the ends of the rod. Con-sidered are shock elastic waves that arise in such structures under the action of shock loads. Regu-lar integral representations of generalized solutions are obtained, which give an analytical solution to the stated BVPs.

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Key words: thermoelastic rod, boundary value problems, method of generalized functions.

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