TWMS J. Pure Appl. Math. V.4, N.1, 2013, pp.110-111

BOOK REVIEW

"Non-stationary viscoelastic waves" - M.Kh.Ilyasov
(Publisher National Aviation Academy, Baku, 2011, 330 p.)

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Elements of constructions by polymer materials and composites and on their basis with widely expressed reological properties are used approximately in all spheres of modern techniques and science: in space technique, in avia-, auto-, shipping- machinbilding, civil engineering, mining industry, radio-electronics, geophysics, bio-mechanics, medicine, etc. Mechanical behavior of these materials is characterized by deformations, relaxation of stresses, and dispersion of waves and dissipation of energy. Materials with this property in solid mechanics are called viscoelastic, which combine the property of elastic solids and viscous fluids.

The main contents of considering monograph are connected with developing of the mathematical methods for solution of initial-boundary value problems of viscoelasticity and investigation of influence of various factors to the thermo-mechanical behavior of the viscoelastic body.

In statements of linear dynamical problems for isotropic viscoelastic material the cases, when 1) the volume deformation is elastic, 2) the Poisson ratio is constant, 3) the shear and volume deformation kernels are the arbitrary (nonproportional) function of time are considered.

The state equations of non-homogeneous anisotropic viscoelastic mediums are taken in the form of product of dependence on space coordinate tensor on four range to the linear Volterra operators with the same relaxation kernel.

Propagation of one dimensional non-stationary connected and non-connected termoviscoelastic waves for any kernel of relaxation in isotropic materials are investigated by using of the small parameter method. The corresponding problem of termoviscoelasticity the dependence of property of material on the non-homogeneous and non-stationary temperature described using the temperature-time analogy with the Vilyams-Landell-Ferry formula.

The method to solution of the linear non-stationary dynamic problems for non-homogeneous anisotropic viscoelastic materials is proposed in the monograph. According to this method the solution of viscoelastic problems are reduced to the solution of the corresponding elastic problems and the solution of some auxiliary linear one dimensional viscoelastic problems for arbitrary kernel of relaxation. For solution of auxiliary problems the author carried out the method of power series for the image of the creep kernel. It is shown that these series are the exact solutions of the corresponding auxiliary problems. The solutions of one-dimensional problems for the Abel, Rjanitsin, Pabotnov and Koltunov weakly singular kernels, for one class of regular kernel, for Maxwell models are constructed by the proposed by author method. The behaviors of these solutions are investigated for short and long times. The numerical method of inverse transformations and comparison of obtained analytic and numerical solutions are presented as well. So the main difficulties of the solution of non-stationary dynamical viscoelastic problems are reduced to the solution of the corresponding elastic problems for nonhomogeneous materials. The slutions of wide class of one- and multidimensional non-stationary dynamical problems for homogeneous and non-homogeneous viscoelastic bodies are obtained in the monograph by using of the offered method. The exact solutions of the problems for viscoelastic sphere and half sphere transformed to the instantaneously concentrated and distributed forces, dynamical torsion of

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viscoelastic cylinders and cones, longitudinal impact to the prismatic roads of circular, sector of circuit and rectangular cross sections etc. are constructed in the monograph.

By analyzing the numerical results the influence of different factors: the behavior of stress for different kernels on the wave front and behind of them for stepped, impulse and sinusoidal mechanically loaded; influence of Poisson ratio; influence of mechanical and temperature connections and dependence of property of material on temperature; influence of dispersion and dissipation; influence of non-homogeneous property; influence of physical nonlinearity etc. to the wave process in viscoelastic body is studied in the monograph.

Brief explanation on the solved concrete problems is given in detail.

The author introduced the analytical solutions of wide range of concrete problems that may be considered as an essential impact of the author.

Results obtained in the monograph will be useful for scientists, engineers working in different fields of science and techniques related with dynamics endurance of constructions of polymeric materials and their composites.