Univ. Prof. Dr. rer. nat. Wolfgang H. MÜLLER **15.11.2012**
Technische Universität Berlin
Fakultät V – Institut für Mechanik
Lehrstuhl für Kontinuumsmechanik und Materialtheorie (LKM)
Sekr. MS 2, Einsteinufer 5, 10587 Berlin

Ankündigung eines Gastvortrages

im Rahmen des Mechanik Seminars

zum Thema

Numerical Studying the Stationary Dynamical Processes in Anisotropic Inhomogeneous Cylindrical Bodies

Ort: **Technische Universität Berlin, Gebäude MS, Raum MS 107**
Mittwoch, 12. Dezember 2012, 16:15 Uhr

Gastdozent:
Prof. Dr. Alexander Grigorenko
Department of Numerical Methods
S.P. Timoshenko Inst. of Mechanics, Kiev, Ukraine

Abstract:

Anisotropic inhomogeneous cylindrical bodies are widely used in aircraft building, shipbuilding, space technology, oil and gas industry, in civil and industrial building as well as in many other fields of modern machine and instrument-making industries. The significant number of scientific publications is devoted to research of their mechanical behaviour. However in the majority of works the case of layered cylindrical structures is considered. But in many cases cylindrical bodies have a continuous, inhomogeneous structure. In the present report the variants of the structural and the constructive inhomogeneities of elastic bodies are considered. Example of bodies with structural inhomogeneity are bodies made of functionally graded materials. An example of bodies with constructive inhomogeneity are bodies with variable thickness. In recent years, a new type of composite materials, the so- called FGMs have been introduced and applied in a wide range of engineering sciences. Functionally graded materials are composite materials, the mechanical properties of which vary continuously due to gradually change of the volume fraction of the constituent materials, usually in thickness direction. Recently cylindrical bodies with the variable thickness including in a circular direction find expanding applications. It is noteworthy attention that the cylindrical structural and constructive inhomogeneous bodies are me-

chanical systems with variable parameters. Investigation of the influence of effect of inhomogeneous structure of considered cylindrical bodies on character of distribution of dynamic parameters and the mechanical behavior is a very important problem of solid mechanics.

As initial mechanical models, the Kirchhoff-Love classic shell theory, the Timoshenko-Mindlin-Reissner refined theory, and the spatial theory of elasticity are used. The mathematical model of the stated problems is described by systems of partial differential equations with variable coefficients. The solution of such a boundary value problem is connected with great difficulties of numerical character. Thus the development of effective numerical methods for defining the mechanical behavior of the anisotropic inhomogeneous cylindrical bodies is a complicated problem due to necessity of solving systems of partial differential equations and in satisfying boundary conditions at bounding surfaces. In this work we propose an efficient numerical technique for the investigation of free axysimmetric and nonaxysimmetric vibrations and wave propagation of hollow anisotropic inhomogeneous cylinders: A spline-approximation is performed along the axial coordinate direction followed by solving a boundary value-problem for the eigen-values of systems of ordinary differential equations of high order with variable coefficients. The stable numerical method of discrete orthogonalization in combination with the method of step-by-step search is applied. Presently such an approach to solving particular classes of problems finds wide applications since it allows for a reduction of the problem to ordinary differential equations based on the approximation of the solution by variable analytical methods. It is used parallel to other universal methods for solving problems of mechanics and mathematical physics, such as finite-differences or finite elements.

The influence of structural and constructive inhomogeneities of cylindrical bodies, the variation in geometrical and mechanical and parameters, and of the boundary conditions is analyzed. The reliability of the obtained results is estimated.