MONOGRAPHS

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Oscillations of Continuous Systems

(with V.A. Krysko)
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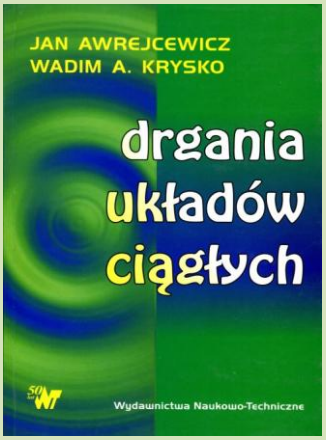
SUMMARY



Preface & Contents

Book Review

This monograph is oriented on the students and the Ph.D. students of mechanical, civil and textile engineering faculties.
In Chapter 1 an introduction into vibrations of continuous system is introduced. In the beginning, a definition of a continuous system is given and then the problems oriented on modeling are illustrated. The differential equations governing dynamics of a string and of a rod are derived. The flexural vibrations of Euler-Timoshenko and Timoshenko beams are described and the variables separation to solve the obtained equations is presented. Next, one-dimensional continuous systems with damping are analysed. A role of external and internal dampings and the rheological models is described. The analysis of membranes, plates and shells is carried out.
Both theoretical and experimental investigations of structurally non-homogeneous plates and shells are reported in Chapter 2. A special emphasis is put on the investigation of small diameter plates and shells used in high technology electronical products. In particular, multi-factors non-homogenuities are analysed and the experimental approaches with the use of a laser technique are addressed. In addition, the non-homogeneous plates and shells are investigated via the finite element and the Bubnov-Galerkin approaches. The results of theoretical, numerical and experimental investigations are compared showing a good agreement.
In Chapter 3 vibrations of plates and shells with the lumped addatives are analysed. The addatives may represent not only the point forces or the load distributed on the small areas but also the lumped oscillators. A three-dimensional orthotropic shell theory accounting the additional masses is introduced. Firstly, an introduction to the theory of elasticity in the curvilinear coordinates is given, and then the variational equation is derived supplemented by the boundary and initial conditions. Then, the approach is reduced to two-dimensional (2D) and one and five coupled nonlinear complex equations are obtained. Therefore, the next step of reduction is introduced. A special emphasis is put on determination of dynamical characteristics of shells with lumped addatives.
The last chapter is devoted to rational design of plates and shells. Optimization is understood in the sense of required dynamical characteristics, minimized masses but possessing the required strength. This chapter is rigorously considered with application of mathematical treatment. Among others, the problem of synthesis and shape optimization of plates and shells with the constraints on dynamical characteristics and power spectra is addressed.