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Elastodynamic Diffraction Problems

Diffraction of Elastic Waves and Dynamic Stress Concentrations. By Y.-H. Pao and C.-C. Mow. Crane, Russak & Co. Inc., New York, 1973. 693 Pages.

REVIEWED BY J. D. ACHENBACH[1]

Elastodynamic stress concentrations near cavities and inclusions can be quite different in magnitude from the corresponding elastostatic stress concentrations. This interesting and typically dynamic effect, which is often due to the diffraction of elastic waves, has generated a good many analytical and experimental studies, including several important ones by Pao and Mow. These authors have now written a monograph in which they have collected the most useful methods of analysis for elastodynamic diffraction problems, together with extensive numerical information on the accompanying stress concentrations.

The book opens with an informative history of studies of elastic wave diffraction. The first chapter also contains sections summarizing the theory of elasticity and a brief discussion of pertinent aspects of wave propagation in elastic solids. In Chapter 2, an analysis of scattering of plane harmonic SH-waves by a cylindrical obstacle serves to introduce methods of analysis. The four remaining chapters present analytical and numerical results for both steady-state and transient diffraction by cylindrical and spherical obstacles. Chapter 3 focuses on a thorough presentation of circular cylinder problems, such as diffraction of longitudinal and transverse waves by cavities and rigid and elastic inclusions. The scattering of flexural waves by a circular inclusion in a plate is also discussed, as is the transient interaction of a circular shell with a surrounding elastic medium. Elliptic cylinder problems and parabolic cylinder problems are discussed in Chapters 4 and 5, respectively. Chapter 5 includes an analysis of the important problem of stress singularities generated by elastodynamic diffraction at the edge of a semi-infinite crack. The last chapter is concerned with the spherical inclusion problem.

This book packs a lot of information which until now was only partially available, and then dispersed in the technical literature. It will be valuable to anyone who is, or should be, interested in elastodynamic effects.

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Introduction to Materials Science

Materials Science. By A. L. Ruoff. Prentice-Hall, Englewood Cliffs, N. J., 1973. vii-928. $18.95 Cloth.

REVIEWED BY A. PHILLIPS[2]

This is an excellent introductory book on material science. It covers a large number of topics making it suitable for any engineer who wishes to be introduced to those aspects of the science of materials which are important for his work. Suitable references at the end of each chapter provide guidance for further study. The book covers material properties and behavior, electrons and atoms, micro and macrostructure, chemical equilibria, kinetics, mechanical properties, electrical properties, optical, and magnetic properties.

It is very well written and it includes a large number of examples and problems. It is a good text for teaching at the undergraduate level.

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This paper deals with the problem of diffraction of elastic waves in the plane multiply-connected regions by the theory of complex functions. The complete function series which approach the solution of the problem and general expressions for boundary conditions are given. Then the problem is reduced to the solution to infinite series of algebraic equations and the solution can be directly obtained by using electronic computer.Â Based on the solution of the diffracted wave field the general formulas for calculating dynamic stress concentration factor for a cavity of arbitrary shape in multiply-connected region are given. Keywords. Algebraic Equation Weak Interaction Elastic Wave Wave Field Complex Function. These keywords were added by machine and not by the authors. A systematic presentation of methods for analyzing both steady and transient stress loadings on diverse objects under various circumstances, and specific numerical findings for dynamic stress concentrations on objects of different shapes. The report shows clearly that the scattering of elastic (stress) waves is no different from the scattering of sound or electromagnetic waves, and much of the analysis is based on wave propagation methods.Â Ironically, the elastic solid theory used was originally developed to explain the diffraction of light â€” and was abandoned after the electromagnetic wave and quantum theories of light appeared. In particular, the problems of diffraction of elastic waves in transtropic layered media and dynamic stability of arbitrarily oriented underground facilities, development of which takes place under the current conditions of underground construction are insufficiently studied. In this paper we try to fill this gap in research and consider the dynamic stress-strain state of horizontal underground structures which are simulated by cavities in an anisotropic layered medium under the conditions of a stationary diffraction of elastic longitudinal (PP) and transverse (SV, SH) waves. III. Diffraction of