MATHEMATICAL PROBLEMS IN ELASTICITY

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Series on Advances in Mathematics for Applied Sciences – Vol. 38

MATHEMATICAL PROBLEMS IN ELASTICITY

editor

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Published by

World Scientific Publishing Co Pte Ltd

P O Box 128, Farrer Road, Singapore 912805

USA office: Suite 1B, 1060 Main Street, River Edge, NJ 07661

UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

Library of Congress Cataloging-in-Publication Data

Mathematical problems in elasticity / editor, Remigio Russo.

vii, 192 p. ; 22.5 cm. -- (Series on advances in mathematics for applied sciences ; vol. 38)

ISBN 9810225768

1. Elasticity. I. Russo, Remigio. II. Series.

QA931.M428 1996

531'.382'0151--dc20

95-48843

CIP

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library.

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This book is printed on acid-free paper.

Printed in Singapore by Uto-Print.

Preface

The relevance of the mathematical theory of Elasticity (in both the linear and nonlinear schemes) in the growth of theoretical knowledge and description of the physical world, as well as in the practical management of some important mechanical phenomena, is widely acknowledged and has been pointed out in most papers, so that it does not require to be emphasized here. Accordingly, the present volume collects five papers that may give a good sample of the problems and the results characterizing some recent trends and advances in this theory. Some of them are devoted to the improvement of a general abstract knowledge of the behaviour of elastic bodies, while the others mainly deal with more applicative topics. We shall now give a brief account of their main aims.

The first paper, due to Ph. Boulanger and M. Hayes, aims at giving a complete and systematic exposition of a body of selected results concerning the propagation of finite-amplitude plane waves in a deformed Mooney-Rivlin material. Such a system, when assumed to be homogeneous, isotropic and incompressible, may be envisaged as a "rubberlike material"

The paper by C. O. Horgan provides a review of recent results concerning the decay at large spatial distance of solutions to (systems of) elliptic partial differential equations. This problem is of great relevance in connection with the well-known Saint-Venant principle in elasticity and also with entry flows for viscous incompressible fluids.

In the third paper, by R. Russo and G. Starita, the well-posedness (existence, uniqueness and continuous dependence of solutions upon the data) of the traction problem in incompressible linear elasticity for three-dimensional exterior domains is proved in the class of solutions with finite energy. In particular, the uniqueness classes there determined may be expected to be maximal, in view of analogous results obtained in the compressible case.

The paper by T. Valent deals with an abstract formulation for boundary problems with symmetries, and with a study of a general perturbation problem with symmetries. This problem is of particular interest, in that it aims at a general treatment of any boundary-value problem in both linear and nonlinear elasticity with external forces explicitly depending on the unknown deformation.

The fifth paper, by L. T. Wheeler, owes its interest to a wide discussion of the applications of maximum principles for scalar-valued functions to classical theory of elasticity. He also shows and discusses a number of counterexamples that may suggest a “boundary” to the possibility of finding a general maximum principle in the framework of linear elasticity.

R. Russo

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