Preface

The book is based on the authors' results on asymptotic approximations of Green's kernels for elliptic boundary value problems in perforated domains. A new feature is the uniformity of the asymptotics with respect to the independent variables. Formal asymptotic approximations are supplied with estimates of the remainder terms. For the case when the number of perforations or inclusions becomes large, a novel method of meso-scale asymptotic approximations is introduced, and uniform asymptotic approximations of Green's kernels as well as solutions of boundary value problems in multiply perforated domains are presented. Such approximations do not require periodicity or other typical constraints attributed to homogenization approximations.

Applications are considered for problems of linear elasticity in planar and three-dimensional domains containing multiple small holes or inclusions. Illustrative computational examples are included to compare asymptotic approximations with accurate finite element numerical simulations, which demonstrate the advantages of the asymptotic method.

This book is addressed to mathematicians, physicists and engineers, as well as research students, interested in asymptotic analysis and numerical computations for solutions to partial differential equations. The required background includes a basic theory of partial differential equations and elements of functional analysis.

Acknowledgements The authors would like to thank the University of Liverpool for providing excellent academic facilities throughout the duration of the project, which has led to this book. The support of the UK Engineering and Physical Sciences Research Council via the grant EP/F005563/1 is gratefully acknowledged.

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http://www.springer.com/978-3-319-00356-6

Green's Kernels and Meso-Scale Approximations in Perforated Domains

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2013, XVII, 258 p. 17 illus., 10 illus. in color., Softcover
ISBN: 978-3-319-00356-6