Preface

One of the more promising non-destructive means of diagnosing the properties of quite complicated materials is to use wave energy as a probe. An analysis of this technique requires a detailed understanding of first how signals evolve in the medium of interest in the absence of inhomogeneities and, second, the nature of the scattered or echo field when the original signal is perturbed by inhomogeneities which might exist in the medium. The overall aim of the analysis is to calculate relationships between an unperturbed signal waveform and an associated echo waveform and indicate how these relationships can be used to characterise inhomogeneities in the medium.

An initial aim of this monograph is to give a largely self-contained, introductory account of acoustic wave propagation and scattering in the presence of time independent perturbations. Later chapters of the book will indicate how the approach adopted here for dealing with acoustic problems can be extended to cater for similar problems in electromagnetism and elasticity.

In this monograph we gather together the principal mathematical topics which are used when dealing with wave propagation and scattering problems involving time independent perturbations. In so doing we will provide a unified and reasonably self-contained introduction to an active research area which has been developing over recent years. We will also indicate how the material can be used to develop constructive methods of solution. The overall intention is to present the material so that is just as persuasive to the theoretician as to the applied scientist who may not have the same mathematical background. This book is meant to be a guide which indicates the technical requirements when investigating wave scattering problems. Throughout the emphasis will be on concepts and results rather than on the fine detail of proof. The proofs of results which are simply stated in the text, many of which are lengthy and very much of a technical nature, can be found in the references cited.

Many of the results described in this book represent the works of a large number of authors and an attempt has been made to provide a reasonably comprehensive Bibliography. However, particular mention must be made of the

pioneering works of Ikebe, Lax and Phillips and of Wilcox. The influence of the works of these authors has been considerable and is gratefully acknowledged. In particular, a profound debt of gratitude is owed to Rolf Leis and Calvin Wilcox who have been such an inspiration over the years.

I would also like to express my gratitude to the many colleagues with whom I have had such useful discussions. In particular, I would thank Christos Athanasiadis, Aldo Belleni-Morante, Wilson Lamb and Ioannis Stratis who have read various parts of the manuscript and offered so many suggestions.

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