# PREFACE

There are many good texts on the application of finite element analysis techniques. Most do not address the concept and implementation of error estimation. Now that computers are so powerful there is no reason not to carry our a re-analysis until the error levels reach the point that the user is satisfied. Having an error estimation is critical to automating the adaptation of the finite element analysis process. Today several commercial programs include automatic adaptation, based on an error analysis. The user of such programs should have a clear concept of the theory and limitations of such tools. Thus, this text includes the basic finite element theory and its mathematical foundations, the error estimation processes, and the associated computational procedures, as well as and several example applications.

This book is primarily intended for advanced undergraduate engineering students and beginning graduate students. The text contains more material than could be covered in a single quarter or semester course. Therefore, a number of chapters or sections that could be omitted in a first course have been marked with an asterisk (∗). Most of the subject matter deals with linear heat transfer and elementary stress analysis.

The future of finite element analysis will probably heavily involve adaptive analysis methods. One should have a course in Functional Analysis to best understand those techniques. Most undergraduate curriculums do not contain such courses. Therefore, a chapter on mathematical preliminaries is included.

All the Fortran 95 source programs for the general finite element library (called MODEL), and the corresponding application and supporting data file can be downloaded from the World Wide Web (for non-commercial use only). They can be found at the site www.owlnet.rice.edu/~mech517. The same is true of a large library of small Matlab plotting scripts that display the input and output results shown in the text.

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