



# The Finite Element Method in Heat Transfer Analysis

*By R. W. Lewis, Ken Morgan, H. R. Thomas, K. N. Seetharamu*

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Heat transfer analysis is a problem of major significance in a vast range of industrial applications. These extend over the fields of mechanical engineering, aeronautical engineering, chemical engineering and numerous applications in civil and electrical engineering. If one considers the heat conduction equation alone the number of practical problems amenable to solution is extensive. Expansion of the work to include features such as phase change, coupled heat and mass transfer, and thermal stress analysis provides the engineer with the capability to address a further series of key engineering problems. The complexity of practical problems is such that closed form solutions are not generally possible. The use of numerical techniques to solve such problems is therefore considered essential, and this book presents the use of the powerful finite element method in heat transfer analysis. Starting with the fundamental general heat conduction equation, the book moves on to consider the solution of linear steady state heat conduction problems, transient analyses and non-linear examples. Problems of melting and solidification are then considered at length followed by a chapter on convection. The application of heat and mass transfer to drying problems and the calculation of both thermal and shrinkage stresses conclude the book. Numerical examples are used to illustrate the basic concepts introduced. This book is the outcome of the teaching and research experience of the authors over a period of more than 20 years.

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- Sales Rank: #3706211 in Books
- Published on: 1996-07-11
- Original language: English
- Number of items: 1
- Dimensions: 9.00" h x .66" w x 6.00" l, 1.05 pounds
- Binding: Paperback
- 290 pages

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