Finite Element Method In Fluid Mechanics Heat Transfer

Finite Element Techniques for Fluid Flow describes the advances in the applications of finite element techniques to fluid mechanics. Topics covered range from weighted residual and variational methods to interpolation functions, inviscid fluids, and flow through porous media. The basic principles and governing equations of fluid mechanics as well as problems related to dispersion and shallow water circulation are also discussed. This text is comprised of nine chapters; the first of which explains some basic definitions and properties as well as the basic principles of weighted residual and variational methods. The reader is then introduced to the simple finite element concepts and models, and gradually to more complex applications. The chapters that follow focus on the governing equations of fluid flow, the solutions to potential type problems, and viscous flow problems in porous media. The solutions to more specialized problems are also presented. This book also considers how circulation problems can be tackled using finite elements, presents a solution to the mass transfer equation, and concludes with an explanation of how to solve general transient incompressible flows. This source will be of use to engineers, applied mathematicians, physicists, self-taught students, and research workers.

This is the first monograph on the subject, providing a comprehensive introduction to the LSFEM method for numerical solution of PDEs. LSFEM is simple, efficient and robust, and can solve a wide range of problems in fluid dynamics and electromagnetics.

The Finite Element Method in Engineering, Fifth Edition, provides a complete introduction to finite element methods with applications to solid mechanics, fluid mechanics, and heat transfer. Written by bestselling author S.S. Rao, this book provides students with a thorough grounding of the mathematical principles for setting up finite element solutions in civil, mechanical, and aerospace engineering applications. The new edition of this textbook includes examples using modern computer tools such as MatLab, Ansys, Nastran, and Abaqus. This book discusses a wide range of topics, including discretization of the domain; interpolation models; higher order and isoparametric elements; derivation of element matrices and vectors; assembly of element matrices and vectors and derivation of system equations; numerical solution of finite element equations; basic equations of fluid mechanics; inviscid and irrotational flows; solution of quasi-harmonic equations; and solutions of Helmhotz and Reynolds equations. New to this edition are examples and applications in Matlab, Ansys, and Abaqus; structured problem solving approach in all worked examples; and new discussions throughout, including the direct method of deriving finite element equations, use of strong and weak form formulations, complete treatment of dynamic analysis, and detailed analysis of heat transfer problems. All figures are revised and redrawn for clarity. This book will benefit professional engineers, practicing engineers learning finite element methods, and students in mechanical, structural, civil, and aerospace engineering. Examples and applications in Matlab, Ansys, and Abaqus Structured problem solving approach in all worked examples New discussions throughout, including the direct method of deriving finite element equations, use of strong and weak form formulations, complete treatment of dynamic analysis, and detailed analysis of heat transfer problems More examples and exercises All figures revised and redrawn for clarity

The book provides a survey of numerical methods for acoustics, namely the finite element method (FEM) and the boundary element method (BEM). It is the first book summarizing FEM and BEM (and optimization) for acoustics. The book shows that both methods can be effectively used for many other cases, FEM even for open domains and BEM for closed ones. Emphasis of the book is put on numerical aspects and on treatment of the exterior problem in acoustics, i.e. noise radiation.

Fundamentals of the Finite Element Method for Heat and Fluid Flow

Implementation of Finite Element Methods for Navier-Stokes Equations

Basic Concepts and Applications

Basics of the Finite Element Method

Basic Control Volume Finite Element Methods for Fluids and Solids

Heat transfer is the area of engineering science which describes the energy transport between material bodies due to a difference in temperature. The three different modes of heat transport are conduction, convection and radiation. In most problems, these three modes exist simultaneously. However, the significance of these modes depends on the problems studied and often, insignificant modes are neglected. Very often books published on Computational Fluid Dynamics using the Finite Element Method give very little or no significance to thermal or heat transfer problems. From the research point of view, it is important to explain the handling of various types of heat transfer problems with different types of complex boundary conditions. Problems with slow fluid motion and heat transfer can be difficult problems to handle. Therefore, the complexity of combined fluid flow and heat transfer problems should not be underestimated and should be dealt with carefully. This book: Is ideal for teaching senior undergraduates the fundamentals of how to use the Finite Element Method to solve heat transfer and fluid dynamics problems Explains how to solve various heat transfer problems with different types of boundary conditions Uses recent computational methods and codes to handle complex fluid motion and heat transfer problems Includes a large number of examples and exercises on heat transfer problems In an era of parallel computing, computational efficiency and easy to handle codes play a major part. Bearing all these points in mind, the topics covered on combined flow and heat transfer in this book will be an asset for practising engineers and postgraduate students. Other topics of interest for the heat transfer community, such as heat exchangers and radiation heat transfer, are also included.

The numerical simulation of fluid mechanics and heat transfer problems is now a standard part of engineering practice. The widespread availability of capable computing hardware has led to an increased demand for computer simulations of products and processes during their engineering design and manufacturing phases. The range of fluid mechanics and heat transfer applications of finite element analysis has become quite remarkable, with complex, realistic simulations being carried out on a routine basis. The award-winning first edition of The Finite Element Method in Heat Transfer and Fluid Dynamics brought this powerful methodology to those interested in applying it to the significant class of problems dealing with heat conduction, incompressible viscous flows, and convection heat transfer. The Second Edition of this bestselling text continues to provide the academic community and industry with up-to-date, authoritative information on the use of the finite element method in the study of fluid mechanics and heat transfer. Extensively revised and thoroughly updated, new and expanded material includes discussions on difficult boundary conditions, contact and bulk nodes, change of phase, weighted-integral statements and weak forms, chemically reactive systems, stabilized methods, free surface problems, and much more. The Finite Element Method in Heat Transfer and Fluid Dynamics offers students a pragmatic treatment that views numerical computation as a means to an end and does not dwell on theory or proof. Mastering its contents brings a firm understanding of the basic methodology, competence in using existing simulation software, and the ability to develop some simpler, special purpose computer codes.

In structure mechanics analysis, finite element methods are now well estab lished and well documented techniques; their advantage lies in a higher flexibility, in particular for: (i) The representation of arbitrary complicated boundaries; (ii) Systematic rules for the developments of stable numerical schemes ap proximating mathematically wellposed problems, with various types of boundary conditions. On the other hand, compared to finite difference methods, this flexibility is paid by: an increased programming complexity; additional storage require ment. The application of finite element methods to fluid mechanics has been lagging behind and is relatively recent for several types of reasons: (i) Historical reasons: the early methods were invented by engineers for the analysis of torsion, flexion deformation of bearns, plates, shells, etc ... (see the historics in Strang and Fix (1972) or Zienckiewicz (1977». (ii) Technical reasons: fluid flow problems present specific difficulties: strong gradients,l of the velocity or temperature for instance, may occur which a finite mesh is unable to properly represent; a remedy lies in the various upwind finite element schemes which recently turned up, and which are reviewed in chapter 2 (yet their effect is just as controversial as in finite differences). Next, waves can propagate (e.g. in ocean dynamics with shallowwaters equations) which will be falsely distorted by a finite non regular mesh, as Kreiss (1979) pointed out. We are concerned in this course with the approximation of incompressible, viscous, Newtonian fluids, i.e. governed by N avier Stokes equations.

As Computational Fluid Dynamics (CFD) and Computational Heat Transfer (CHT) evolve and become increasingly important in standard engineering design and analysis practice, users require a solid understanding of mechanics and numerical methods to make optimal use of available software. The Finite Element Method in Heat Transfer and Fluid Dynamics, Third Edition illustrates what a user must know to ensure the optimal application of computational procedures—particularly the Finite Element Method (FEM)—to important problems associated with heat conduction, incompressible viscous flows, and convection heat transfer. This book follows the tradition of the bestselling previous editions, noted for their concise explanation and powerful presentation of useful methodology tailored for use in simulating CFD and CHT. The authors update research developments while retaining the previous editions' key material and popular style in regard to text organization, equation numbering, references, and symbols. This updated third edition features new or extended coverage of: Coupled problems and parallel processing Mathematical preliminaries and low-speed compressible flows Mode superposition methods and a more detailed account of radiation solution methods Variational multi-scale methods (VMM) and least-squares finite element models (LSFEM) Application of the finite element method to non-isothermal flows Formulation of low-speed, compressible flows With its presentation of realistic, applied examples of FEM in thermal and fluid design analysis, this proven masterwork is an invaluable tool for mastering basic methodology, competently using existing simulation software, and developing simpler special-purpose computer codes. It remains one of the very best resources for understanding numerical methods used in the study of fluid mechanics and heat transfer phenomena.

Finite Element Analysis in Fluid Dynamics

Characteristics Finite Element Methods in Computational Fluid Dynamics

The Least-Squares Finite Element Method

Computational Acoustics of Noise Propagation in Fluids - Finite and Boundary Element Methods

Introduces the formulation of problems in fuild mechanics and dynamics, and shows how they can be analyzed and resolved using finite element methods. This practical book also discusses the equations of fluid mechanics and investigates the problems to which these equations can be applied, as well as how they can be analyzed and solved. Contains illustrations of computer simulations using the methods described in the book and features numerous illustrations.

This much-anticipated second edition introduces the fundamentals of the finite element method featuring clear-cut examples and an applications-oriented approach. Using the transport equation for heat transfer as the foundation for the governing equations, this new edition demonstrates the versatility of the method for a wide range of applications, including structural analysis and fluid flow. Much attention is given to the development of the discrete set of algebraic equations, beginning with simple one-dimensional problems that can be solved by inspection, continuing to two- and three-dimensional elements, and ending with three chapters describing applications. The increased number of example problems per chapter helps build an understanding of the method to define and organize required initial and boundary condition data for specific problems. In addition to exercises that can be worked out manually, this new edition refers to user-friendly computer codes for solving one-, two-, and three-dimensional problems. Among the first FEM textbooks to include finite element software, the book contains a website with access to an even more comprehensive list of finite element software written in FEMLAB, MAPLE, MathCad, MATLAB, FORTRAN, C++, and JAVA - the most popular programming languages. This textbook is valuable for senior level undergraduates in mechanical, aeronautical, electrical, chemical, and civil engineering. Useful for short courses and home-study learning, the book can also serve as an introduction for first-year graduate students new to finite element coursework and as a refresher for industry professionals. The book is a perfect lead-in to Intermediate Finite Element Method: Fluid Flow and Heat and Transfer Applications (Taylor & Francis, 1999, Hb 1560323094).

This book details a systematic characteristics-based finite element procedure to investigate incompressible, free-surface and compressible flows. Several sections derive the Fluid Dynamics equations from first thermo-mechanics principles and develop this multi-dimensional and infinite-directional upstream procedure by combining a finite element discretization with an implicit non-linearly stable Runge-Kutta time integration for the numerical solution of the Euler and Navier Stokes equations.

The Control Volume Finite Element Method (CVFEM) is a hybrid numerical methods, combining the physics intuition of Control Volume Methods with the geometric flexibility of Finite Element Methods. The concept of this monograph is to introduce a common framework for the CVFEM solution so that it can be applied to both fluid flow and solid mechanics problems. To emphasize the essential ingredients, discussion focuses on the application to problems in two-dimensional domains which are discretized with linear-triangular meshes. This allows for a straightforward provision of the key information required to fully construct working CVFEM solutions of basic fluid flow and solid mechanics problems.

A Practical Guide

Finite Element Methods and Their Applications

Solid Mechanics, Heat Transfer, and Fluid Mechanics

The Finite Element Method for Engineers

Advances in Finite Element Analysis in Fluid Dynamics

Introduce every concept in the simplest setting and to maintain a level of treatment that is as rigorous as possible without being unnecessarily abstract. Contains unique recent developments of various finite elements such as nonconforming, mixed, discontinuous, characteristic, and adaptive finite elements, along with their applications. Describes unique recent applications of finite element methods to important fields such as multiphase flows in porous media and semiconductor modelling. Treats the three major types of partial differential equations, i.e., elliptic, parabolic, and hyperbolic equations.

Over the past several years, significant advances have been made in developing the discontinuous Galerkin finite element method for applications in fluid flow and heat transfer. Certain unique features of the method have made it attractive as an alternative for other popular methods such as finite volume and finite elements in thermal fluids engineering analyses. This book is written as an introductory textbook on the discontinuous finite element method for senior undergraduate and graduate students in the area of thermal science and fluid dynamics. It also can be used as a reference book for researchers and engineers who intend to use the method for research in computational fluid dynamics and heat transfer. A good portion of this book has been used in a course for computational fluid dynamics and heat transfer for senior undergraduate and first year graduate students. It also has been used by some graduate students for self-study of the basics of discontinuous finite elements. This monograph assumes that readers have a basic understanding of thermodynamics, fluid mechanics and heat transfer and some background in numerical analysis. Knowledge of continuous finite elements is not necessary but will be helpful. The book covers the application of the method for the simulation of both macroscopic and micro/nanoscale fluid flow and heat transfer phenomena.

This informal introduction to computational fluid dynamics and practical guide to numerical simulation of transport phenomena covers the derivation of the governing equations, construction of finite element approximations, and qualitative properties of numerical solutions, among other topics. To make the book accessible to readers with diverse interests and backgrounds, the authors begin at a basic level and advance to numerical tools for increasingly difficult flow problems, emphasizing practical implementation rather than mathematical theory. Finite Element Methods for Computational Fluid Dynamics: A Practical Guide explains the basics of the finite element method (FEM) in the context of simple model problems, illustrated by numerical examples. It comprehensively reviews stabilization techniques for convection-dominated transport problems, introducing the reader to streamline diffusion methods, Petrov?Galerkin approximations, Taylor?Galerkin schemes, flux-corrected transport algorithms, and other nonlinear high-resolution schemes, and covers Petrov?Galerkin stabilization, classical projection schemes, Schur complement solvers, and the implementation of the k-epsilon turbulence model in its presentation of the FEM for incompressible flow problem. The book also describes the open-source finite element library ELMER, which is recommended as a software development kit for advanced applications in an online component.

Coverage of the whole range of fluid dynamics - including incompressible slow viscous flow, high-speed supersonic flows, shallow water flow, ocean waves, and metal and plastic forming. Up-to-date material on the Characteristic Galerkin Method. New methodologies for dealing with supersonic and hypersonic behaviours. New material on free surface phenomena. "...the publication of the first edition was an epoch making event...it is written by...the greatest theorist of the subject. If you are serious about finite elements, this is a book that you simply cannot afford to be without." International Journal of Numerical Methods in Engineering. "...the pre-eminent reference work on finite element analysis." Applied Mechanical Review. "...a very good book...presentation is first class...will be of great assistance to all engineers and scientists interested in the method...a very commendable piece of work.—"Journal of the British Society for Strain Measurement.

The Finite Element Method: For fluid dynamics

The Intermediate Finite Element Method

Finite Element Methods for Incompressible Flow Problems

Discontinuous Finite Elements in Fluid Dynamics and Heat Transfer

The Finite Element Method, Fluid Dynamics

This textbook begins with the finite element method (FEM) before focusing on FEM in heat transfer and fluid mechanics.

Fluid-Structure Interaction: An Introduction to Finite Element Coupling fulfils the need for an introductive approach to the general concepts of Finite and Boundary Element Methods for FSI, from the mathematical formulation to the physical interpretation of numerical simulations. Based on the author's experience in developing numerical codes for industrial applications in shipbuilding and in teaching FSI to both practicing engineers and within academia, it provides a comprehensive and self–contained guide that is geared toward both students and practitioners of mechanical engineering. Composed of six chapters, Fluid–Structure Interaction: An Introduction to Finite Element Coupling progresses logically from formulations and applications involving structure and fluid dynamics, fluid and structure interactions and opens to reduced order-modelling for vibro-acoustic coupling. The author describes simple yet fundamental illustrative examples in detail, using analytical and/or semi–analytical formulation & designed both to illustrate each numerical method and also to highlight a physical aspect of FSI. All proposed examples are simple enough to be computed by the reader using standard computational tools such as MATLAB, making the book a unique tool for self–learning and understanding the basics of the techniques for FSI, or can serve as verification and validation test cases of industrial FEM/BEM codes rendering the book valuable for code verification and validation purposes.

Connecting theory with numerical techniques using MATLAB®, this practical textbook equips students with the tools required to solve finite element problems. This hands-on guide covers a wide range of engineering problems through nine well-structured chapters including solid mechanics, heat transfer and fluid dynamics; equilibrium, steady state and transient; and 1-D, 2-D and 3-D problems. Engineering problems are discussed using case study examples, which are solved using a systematic approach, both by examining the steps manually and by implementing a complete MATLAB®code. This topical coverage is supplemented by discourse on meshing with a detailed explanation and implementation of 2-D meshing algorithms. Introducing theory and numerical techniques alongside comprehensive examples this text increases engagement and provides students with the confidence needed to implement their own computer codes to solve given problems.

The Finite Element MethodIts Basis and FundamentalsButterworth Heinemann

Least-squares Finite Element Method for Fluid Dynamics

An Introduction to the Finite Element Method

The Finite Element Method in Engineering

A Space-time Finite Element Method for Fluid-structure Interaction

An Introduction to Finite Element Coupling

With the revolution in readily available computing power, the finite element method has become one of the most important tools for the modern engineer. This book offers a comprehensive introduction to the principles involved.

The Finite Element Method: Its Basis and Fundamentals offers a complete introduction to the basis of the finite element method, covering fundamental theory and worked examples in the detail required for readers to apply the knowledge to their own engineering problems and understand more advanced applications. This edition sees a significant rearrangement of the book's content to enable clearer development of the finite element method, with major new chapters and sections added to cover: Weak forms Variational forms Multi-dimensional field problems Automatic mesh generation Plate bending and shells Developments in meshless techniques Focusing on the core knowledge, mathematical and analytical tools needed for successful application, The Finite Element Method: Its Basis and Fundamentals is the authoritative resource of choice for graduate level students, researchers and professional engineers involved in finite element-based engineering analysis. A proven keystone reference in the library of any engineer needing to understand and apply the finite element method in design and development. Founded by an influential pioneer in the field and updated in this seventh edition by an author team incorporating academic authority and industrial simulation experience. Features reworked and reordered contents for clearer development of the theory, plus new chapters and sections on mesh generation, plate bending, shells, weak forms and variational forms.

In recent years there have been significant developments in the development of stable and accurate finite element procedures for the numerical approximation of a wide range of fluid mechanics problems. Taking an engineering rather than a mathematical bias, this valuable reference resource details the fundamentals of stabilised finite element methods for the analysis of steady and time-dependent fluid dynamics problems. Organised into six chapters, this text combines theoretical aspects and practical applications and offers coverage of the latest research in several areas of computational fluid dynamics. * Coverage includes new and advanced topics unavailable elsewhere in book form * Collection in one volume of the widely dispersed literature reporting recent progress in this field * Addresses the key problems and offers modern, practical solutions Due to the balance between the concise explanation of the theory and the detailed description of modern practical applications, this text is suitable for a wide audience including academics, research centres and government agencies in aerospace, automotive and environmental engineering.

This book explores finite element methods for incompressible flow problems: Stokes equations, stationary Navier-Stokes equations and time-dependent Navier-Stokes equations. It focuses on numerical analysis, but also discusses the practical use of these methods and includes numerical illustrations. It also provides a comprehensive overview of analytical results for turbulence models. The proofs are presented step by step, allowing readers to more easily understand the analytical techniques.

Finite Element Methods for Flow Problems

Theory and Applications in Computational Fluid Dynamics and Electromagnetics

Finite Element Analysis of Fluid Flows

The Finite Element Method for Fluid Dynamics

Finite Element Methods for Fluids

New York : McGraw-Hill International Book Co., c1978.

The book retains its strong conceptual approach, clearly examining the mathematical underpinnings of FEM, and providing a general approach of engineering application areas.Known for its detailed, carefully selected example problems and extensive selection of homework problems, the author has comprehensively covered a wide range of engineering areas making the book approriate for all engineering majors, and underscores the wide range of use FEM has in the professional world

A useful balance of theory, applications, and real-world examples The Finite Element Method for Engineers, Fourth Edition presents a clear, easy-to-understand explanation of finite element fundamentals and enables readers to use the method in research and in solving practical, real-life problems. It develops the basic finite element method mathematical formulation, beginning with physical considerations, proceeding to the well-established variation approach, and placing a strong emphasis on the versatile method of weighted residuals, which has shown itself to be important in nonstructural applications. The authors demonstrate the tremendous power of the finite element method to solve problems that classical methods cannot handle, including elasticity problems, general field problems, heat transfer problems, and fluid mechanics problems. They supply practical information on boundary conditions and mesh generation, and they offer a fresh perspective on finite element analysis with an overview of the current state of finite element optimal design. Supplemented with numerous real-world problems and examples taken directly from the authors' experience in industry and research, The Finite Element Method for Engineers, Fourth Edition gives readers the real insight needed to apply the method to challenging problems and to reason out solutions that cannot be found in any textbook.

This book covers all basic areas of mechanical engineering, such as fluid mechanics, heat conduction, beams and elasticity with detailed derivations for the mass, stiffness and force matrices. It is especially designed to give physical feeling to the reader for finite element approximation by the introduction of finite elements to the elevation of elastic membrane. A detailed treatment of computer methods with numerical examples are provided. In the fluid mechanics chapter, the conventional and vorticity transport formulations for viscous incompressible fluid flow with discussion on the method of solution are presented. The variational and Galerkin formulations of the heat conduction, beams and elasticity problems are also discussed in detail. Three computer codes are provided to solve the elastic membrane problem. One of them solves the Poisson's equation. The second computer program handles the two dimensional elasticity problems and the third one presents the three dimensional transient heat conduction problems. The programs are written in C++ environment.

The Finite Element Method with Heat Transfer and Fluid Mechanics Applications

The Finite Element Method in Heat Transfer and Fluid Dynamics, Second Edition

Finite Elements Methods in Mechanics

Finite Element Methods for Computational Fluid Dynamics

The Finite Element Method in Heat Transfer and Fluid Dynamics, Third Edition

This book is a follow-up to the introductory text written by the same authors. The primary emphasis on this book is linear and nonlinear partial differential equations with particular concentration on the equations of viscous fluid motion. Each chapter describes a particular application of the finite element method and illustrates the concepts through example problems. A comprehensive appendix lists computer codes for 2-D fluid flow and two 3-D transient codes.

The finite element method is applied to several simple cases of steady flow of a perfect, incompressible fluid. It is shown that the finite element representation accurately reflects the behavior of the classical flow equations. Finite elements form the basis for a versatile analysis procedure applicable to problems in several different fields. The earliest applications were to problems in structural mechanics. In recent years, nonstructural problems also have been treated by this method. The finite element method represents an approximate procedure for satisfying the problem in terms of its variational formulation. In structural mechanics this is generally accomplished by determining displacement fields based on satisfying the minimum potential energy theorem. Consequently, finite elements furnish a useful alternative scheme for applying the well-known Ritz method. For nonstructural problems, it is essential that the appropriate variational expressions be known beforehand. For the flow problems taken up in this paper, such expressions are well known. The governing matrix equation for the assemblage of elements is based on the properties derived for a single typical element. These properties, in turn, depend on assuming a mathematical form for the primary unknown of the problem and then satisfying the variational principle. For the elasticity problem, the unknowns are the displacements, while for the perfect incompressible fluid, either the velocity potential or the stream function may be used. Of great interest is that structural and nonstructural elements may often be identical in shape and may be represented by similar mathematical expressions. By way of illustration, the problems taken up in this paper were solved using the new ASTRA structural program developed at The Boeing Company. Finally, it should be pointed out that the major difference between the elasticity and fluid flow problems lies in the boundary conditions to be satisfied.

The Finite Element Method for Fluid Dynamics offers a complete introduction the application of the finite element method to fluid mechanics. The book begins with a useful summary of all relevant partial differential equations before moving on to discuss convection stabilization procedures, steady and transient state equations, and numerical solution of fluid dynamic equations. The character-based split (CBS) scheme is introduced and discussed in detail, followed by thorough coverage of incompressible and compressible fluid dynamics, flow through porous media, shallow water flow, and the numerical treatment of long and short waves. Updated throughout, this new edition includes new chapters on: Fluid-structure interaction, including discussion of one-dimensional and multidimensional problems Biofluid dynamics, covering flow throughout the human arterial system Focusing on the core knowledge, mathematical and analytical tools needed for successful computational fluid dynamics (CFD), The Finite Element Method for Fluid Dynamics is the authoritative introduction of choice for graduate level students, researchers and professional engineers. A proven keystone reference in the library of any engineer needing to understand and apply the finite element method to fluid mechanics Founded by an influential pioneer in the field and updated in this seventh edition by leading academics who worked closely with Olgierd C. Zienkiewicz Features new chapters on fluid-structure interaction and biofluid dynamics, including coverage of one-dimensional flow in flexible pipes and challenges in modeling systemic arterial circulation

An Application of the Finite Element Method in Fluid Mechanics

Introduction to the Finite Element Method and Implementation with MATLAB®

Fluid-Structure Interaction

The Finite Element Method for Fluid Dynamics, Sixth Edition

Its Basis and Fundamentals