

An introduction to the computational fluid dynamics

Synopsis:

The emphasis in this book is on assisting engineering and physical science students in cultivating comprehensive skills in finite difference methodology. Based on courses taught at Universiti Teknologi Malaysia, it ranges from fundamental concepts to practical computer implementations. Each technique in finite difference is described from an implementation standpoint and full mathematical justification is discussed to add more understanding on the method. This introductory book is directed toward students without in-depth mathematical training which contain introductory material on the mathematical theory of finite difference making it an ideal reference book for future work in engineering and science.

The text contains of five sections. The basic governing equations of fluid flow and heat transfer are provided in Section 1. The equations are thoroughly derived to serve as an introductory text for students from varied backgrounds. Coverage of the basic discretisation using finite difference technique is introduced in Section 2. The section briefly reviews the characteristics of partial differential equations that have important implications for the numerical schemes. Then, the basic discretisation techniques are highlighted and several popular discretisation techniques for solving basic fluid flow and heat equations are presented. Section 3 contains some solutions for solving simple fluid flow and heat transfer problems. The FORTRAN computer program codes for each example are shown. Section 4 deals with numerical solution to the problems that requires full solution to the Navier-Stokes equation. The section includes a discussion on implementing appropriate boundary conditions for specific problem case. Again, the FORTRAN computer program code are given for all examples.

Finally, in Section 5, the lattice Boltzmann method is introduced as the latest technique in solving fluid flow and heat transfer. The author wishes the readers the best of success in applying the method and looks forward to receiving comments regarding the contents of the book.

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Contents

Preface

Nomenclature

Chapter One The Governing Equations

Introduction

The Governing Equations

The Continuity Equation

The Navier-Stokes Equation

The Energy Equation

The Stream Function-vorticity Equation

Dimensionless Governing Equations

Chapter Two The Partial Differential Equations

Introduction

Finite Different Discretisation

Discretisation in Space

Discretisation in Time

Solution to Advection Equation

Euler Explicit Method

First Order Upwind Method

Lax Method

Leap Frog Method

Lax-Wendroff Method

MacCormack Method

Solution to Laplace's Equation

Five-point Formula

Nine-point Formula

Solution to Heat Equation

Explicit Approach

Implicit Approach

Chapter Three Some Solutions to the Navier-Stokes Equation

Introduction

Incompressible Couette Flow

Thermal Fluid Flow in Plane Duct

Chapter Four Solutions to the Full Navier-Stokes Equation

Introduction

Natural Convection Heat Transfer

Transient Lid-driven Cavity Flow

Cubic Interpolated Profile (CIP) Method

CIP Solution for Two Dimensional Stream Function-vorticity Equation

Chapter Five The Lattice Boltzmann Method

Introduction

Lattice Boltzmann BGK Equation

Dimensionless Lattice Boltzmann BGK Equation

Macroscopic Variables

Boundary Conditions

No-slip Bounce-back

Von-Neumann Boundaries

LBM Simulation Results

Isothermal Fluid Flow

Thermal Fluid Flow

Appendix A First Order Upwind Method

Appendix B Lax Wendroff Method

Appendix C Couette Flow

Appendix D Thermal Fluid Flow in a Plane Duct

Appendix E Natural Convection Heat Transfer

Appendix F Cubic Interpolated Profile Method

Appendix G CIP Solution for 2-D flow

Bibliography

Index