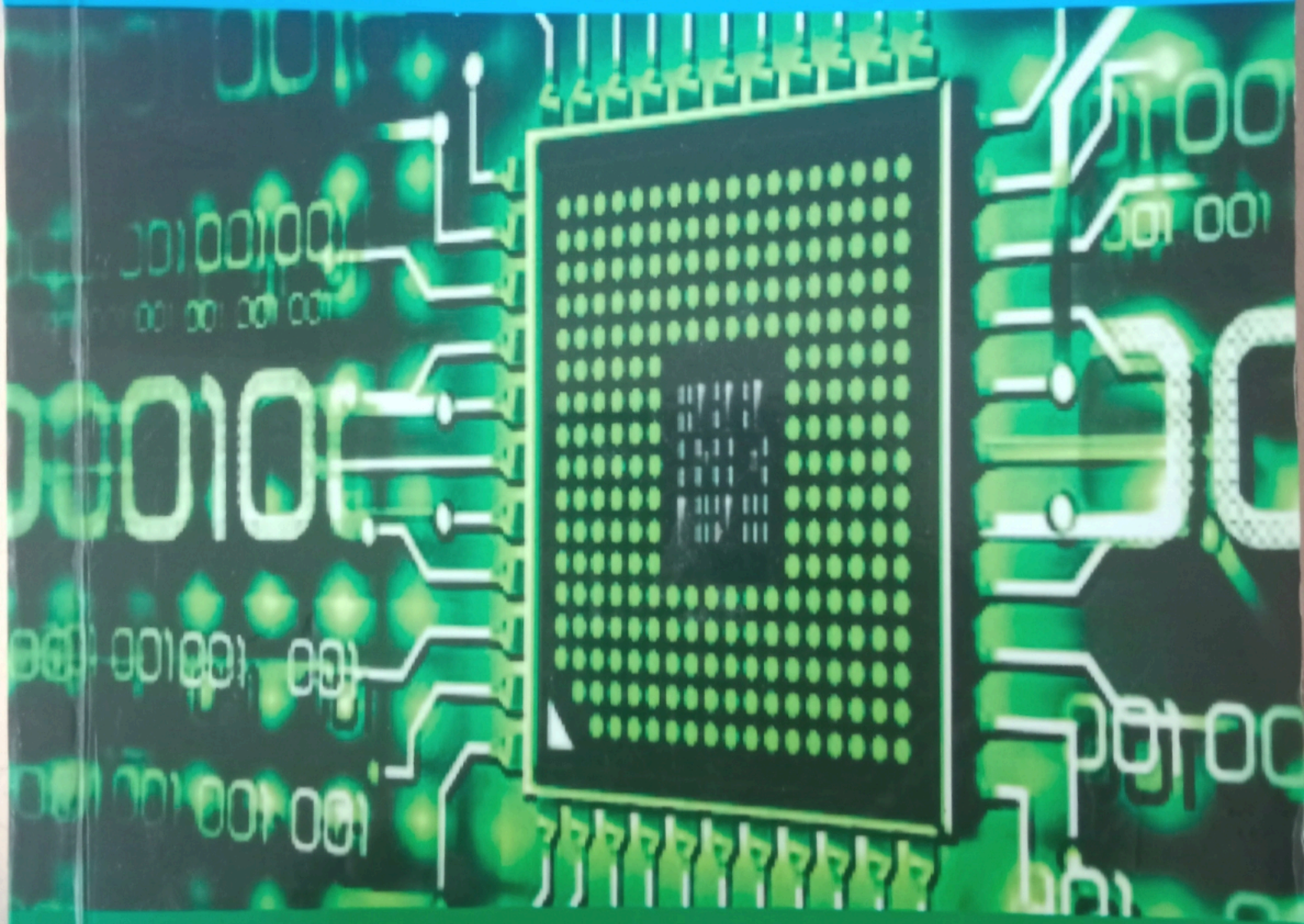
MULTICORE ARCHITECTURES AND PROGRAMMING



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Multicore Architectures and Programming

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Dedicated to

our

Beloved Parents

Preface

It gives us immense pleasure to publish the book titled "MULTICORE ARCHITECTURES AND PROGRAMMING". This book offers the fundamental and programming concepts of Multicore architectures and describes the differences between single-core and multi-core systems. It also addresses the parallel programming concepts and its challenges. This book has been framed as per the Anna University syllabus and can be used as text book for the students.

Organization of book:

Chapter 1: This chapter gives introduction to single-core and multi-core architectures. It describes the interaction between hardware and software in multicore machines. It also provides basic idea about parallel program design and explores the performance of parallel programs.

Chapter 2: This chapter deals with parallel programming challenges like synchronization and data sharing. It helps the students to understand various synchronization methods and coordination mechanism available on latest multicore machines.

Chapter 3: This chapter introduces OpenMP programming for shared memory systems. The directives and library functions used in OpenMP are explained in an understandable way. It enables the students to identify the challenges in writing efficient programs for shared memory architecture.

Chapter 4: This chapter introduces MPI programming for distributed memory systems. It helps the students to learn about various parallel programming paradigms like MPI constructs and library functions for distributed memory architecture.

Chapter 5: This chapter deals with the case study of n-body solver problem and tree search problem. Detailed implementations of these case studies using OpenMP programming and MPI programming also included. Comparison between OpenMP and MPI programming helps the students to understand the concept easily.

At the end of this book, possible two marks questions with answers and previous year Anna University question papers also included for the betterment of students.

Syllabus

MULTI-CORE ARCHITECTURES AND PROGRAMMING (CS6801)

UNIT I MULTI-CORE PROCESSORS

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design.

UNIT II PARALLEL PROGRAM CHALLENGES

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation.

UNIT V PARALLEL PROGRAM DEVELOPMENT

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

Table of Contents

MULTICORE ARCHITECTURES AND PROGRAMMING

This book offers the fundamental and programming concepts of Multicore architectures and describes the differences between single-core and multi-core systems. It addresses various parallel programming techniques like OpenMP and MPI to increase program performance in multi-core architectures. The book is organized based on Anna University syllabus and it provides detailed explanation to understand the concepts. The main objective is to facilitate the parallel programming skills for shared and distributed memory architectures.Two marks question answers and Anna University question papers are also included, which will help students for better preparation.

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