

Introduction to Parallel Programming and pMatlab v2.0

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Abstract

The computational demands of software continue to outpace the capacities of processor and memory technologies, especially in scientific and engineering programs. One option to improve performance is parallel processing. However, despite decades of research and development, writing parallel programs continues to be difficult. This is especially the case for scientists and engineers who have limited backgrounds in computer science. MATLAB[®], due to its ease of use compared to other programming languages like C and Fortran, is one of the most popular languages for implementing numerical computations, thus making it an excellent platform for developing an accessible parallel computing framework.

The MIT Lincoln Laboratory has developed two libraries, pMatlab and MatlabMPI, that not only enables parallel programming with MATLAB in a simple fashion, accessible to non-computer scientists. This document will overview basic concepts in parallel programming and introduce pMatlab.

1. Introduction

Even as processor speeds and memory capacities continue to rise, they never seem to be able to satisfy the increasing demands of software; scientists and engineers routinely push the limits of computing systems to tackle larger, more detailed problems. In fact, they often must scale back the size and accuracy of their simulations so that they may complete in a reasonable amount of time or fit into memory. The amount of processing power directly impacts the scale of the problem being addressed.

One option for improving performance is parallel processing. There have been decades of research and development in hardware and software technologies to allow programs to run on multiple processors, improving the performance of computationally intensive applications. Yet writing accurate, efficient, high performance parallel code is still highly non-trivial, requiring a substantial amount of time and energy to master the discipline of high performance computing, commonly referred to as HPC. However, the primary concern of most scientists and engineers is conduct research, not to write code.

MATLAB[®] is the dominant programming language for implementing numerical computations and is widely used for algorithm development, simulation, data reduction, testing and evaluation. MATLAB users achieve high productivity because one line of MATLAB code can typically replace multiple lines of C or Fortran code. In addition, MATLAB supports a range of operating systems and processor architectures, providing portability and flexibility. Thus MATLAB provides an excellent platform on which to create an accessible parallel computing framework.

The MIT Lincoln Laboratory has been developing technology to allow MATLAB users to benefit from the advantages of parallel programming. Specifically, two MATLAB libraries –

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Programming Brian Bramer, Susan Bramer, 1991 The Motorola MC 68000 family of microprocessors is used in many microcomputers ranging from single board development systems up to professional workstations It continues to be employed in business and industrial applications The second edition of this introduction has been totally revised to cover the latest advances in microprocessor technology *Professional C# 7 and .NET Core 2.0* Christian Nagel, 2018-03-21 The professional s guide to C 7 with expert guidance on the newest features Professional C 7 and NET Core 2 0 provides experienced programmers with the information they need to work effectively with the world s leading programming language The latest C update added many new features that help you get more done in less time and this book is your ideal guide for getting up to speed quickly C 7 focuses on data consumption code simplification and performance with new support for local functions tuple types record types pattern matching non nullable reference types immutable types and better support for variables Improvements to Visual Studio will bring significant changes to the way C developers interact with the space bringing NET to non Microsoft platforms and incorporating tools from other platforms like Docker Gulp and NPM Guided by a leading NET expert and steeped in real world practicality this guide is designed to get you up to date and back to work With Microsoft speeding up its release cadence while offering more significant improvement with each update it has never been more important to get a handle on new tools and features quickly This book is designed to do just that and more everything you need to know about C is right here in the single volume resource on every developer s shelf Tour the many new and enhanced features packed into C 7 and NET Core 2 0 Learn how the latest Visual Studio update makes developers jobs easier Streamline your workflow with a new focus on code simplification and performance enhancement Delve into improvements made for localization networking diagnostics deployments and more Whether you re entirely new to C or just transitioning to C 7 having a solid grasp of the latest features allows you to exploit the language s full functionality to create robust high quality apps Professional C 7 and NET Core 2 0 is the one stop guide to everything you need to know

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Table of Contents Chapter 29 Introduction To Parallel Programming

1. Understanding the eBook Chapter 29 Introduction To Parallel Programming
 - The Rise of Digital Reading Chapter 29 Introduction To Parallel Programming
 - Advantages of eBooks Over Traditional Books
2. Identifying Chapter 29 Introduction To Parallel Programming
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Chapter 29 Introduction To Parallel Programming
 - User-Friendly Interface
4. Exploring eBook Recommendations from Chapter 29 Introduction To Parallel Programming
 - Personalized Recommendations
 - Chapter 29 Introduction To Parallel Programming User Reviews and Ratings
 - Chapter 29 Introduction To Parallel Programming and Bestseller Lists

5. Accessing Chapter 29 Introduction To Parallel Programming Free and Paid eBooks
 - Chapter 29 Introduction To Parallel Programming Public Domain eBooks
 - Chapter 29 Introduction To Parallel Programming eBook Subscription Services
 - Chapter 29 Introduction To Parallel Programming Budget-Friendly Options
6. Navigating Chapter 29 Introduction To Parallel Programming eBook Formats
 - ePub, PDF, MOBI, and More
 - Chapter 29 Introduction To Parallel Programming Compatibility with Devices
 - Chapter 29 Introduction To Parallel Programming Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Chapter 29 Introduction To Parallel Programming
 - Highlighting and Note-Taking Chapter 29 Introduction To Parallel Programming
 - Interactive Elements Chapter 29 Introduction To Parallel Programming
8. Staying Engaged with Chapter 29 Introduction To Parallel Programming
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Chapter 29 Introduction To Parallel Programming
9. Balancing eBooks and Physical Books Chapter 29 Introduction To Parallel Programming
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Chapter 29 Introduction To Parallel Programming
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Chapter 29 Introduction To Parallel Programming
 - Setting Reading Goals Chapter 29 Introduction To Parallel Programming
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Chapter 29 Introduction To Parallel Programming
 - Fact-Checking eBook Content of Chapter 29 Introduction To Parallel Programming
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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