

High Performance Reconfigurable Computing for Science and Engineering Applications

by

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Abstract

This thesis investigates the feasibility of using reconfigurable computers for scientific applications. We review recent developments in reconfigurable high performance computing. We then present designs and implementation details of various scientific applications that we developed for the SRC-6 reconfigurable computer. We present performance measurements and analysis of the results obtained.

We chose a selection of applications from bioinformatics, physics and financial mathematics, including automatic docking of molecular models into electron density maps, lattice gas fluid dynamics simulations, edge detection in images and Monte Carlo options pricing simulations.

We conclude that reconfigurable computing is a maturing field that may provide considerable benefit to scientific applications in the future. At present the performance gains offered by reconfigurable computers are not sufficient to justify the expense of the systems, and the software development environment lacks the language features and library support that application developers require so that they can focus on developing correct software rather than on software infrastructure.

Contents

| | | |
|----------|--|-----------|
| 1 | Introduction | 1 |
| 1.1 | Background | 1 |
| 1.2 | Objectives | 3 |
| 1.2.1 | Investigate the State-of-the-art in Reconfigurable Computing | 3 |
| 1.2.2 | Implement Scientific Computing Algorithms on Reconfigurable Computers | 4 |
| 1.2.3 | Analyze the Performance of Scientific Applications on Reconfigurable Computers | 4 |
| 1.2.4 | Provide Guidance on the Methodology for Developing Software for Reconfigurable Computers | 4 |
| 1.3 | Motivation for Problems Studied | 5 |
| 1.4 | Thesis Outline and Summary | 6 |
| 2 | An Introduction to Reconfigurable Computing | 10 |
| 2.1 | Reconfigurable Computing Hardware | 11 |
| 2.1.1 | Where do reconfigurable computers get their speed from? | 12 |
| 2.2 | Reconfigurable Computing Software | 13 |
| 2.3 | Measuring Performance in Reconfigurable Computing Systems | 14 |
| 2.4 | Conclusion | 15 |
| 3 | Monte Carlo Methods on Reconfigurable Computers | 16 |
| 3.1 | Monte Carlo Methods | 16 |
| 3.2 | Monte Carlo Estimation of π | 17 |

| | | |
|----------|--|-----------|
| 3.2.1 | Implementation of a Parallel Pseudorandom Number Generator | 19 |
| 3.2.2 | Design and Implementation of the Monte Carlo π Estimator | 25 |
| 3.2.3 | Performance Results | 29 |
| 3.3 | Monte Carlo Options Pricing | 32 |
| 3.3.1 | Pricing Asian Options with Monte Carlo | 33 |
| 3.3.2 | Generating Normal Random Variables | 36 |
| 3.3.3 | Design and Implementation | 37 |
| 3.3.4 | Performance Results | 43 |
| 3.4 | Conclusion | 45 |
| 4 | Cellular Automata Simulations on Reconfigurable Computers | 48 |
| 4.1 | An Introduction to Cellular Automata | 49 |
| 4.1.1 | One-dimensional Cellular Automata | 49 |
| 4.1.2 | Two-dimensional Cellular Automata | 51 |
| 4.2 | Conway's Game of Life | 52 |
| 4.2.1 | Design and Implementation | 53 |
| 4.2.2 | Performance Results | 71 |
| 4.3 | Fluid Dynamics Simulations using the Lattice Gas Method | 73 |
| 4.3.1 | Design and Implementation | 75 |
| 4.3.2 | Performance Results | 79 |
| 4.4 | Conclusion | 79 |
| 5 | Image Processing – Edge Detection on Reconfigurable Computers | 81 |
| 5.1 | An Introduction to the Sobel Edge Detection Algorithm | 81 |
| 5.2 | Edge Detection on a Reconfigurable Computer | 84 |
| 5.2.1 | Design and Implementation | 84 |
| 5.2.2 | Results | 88 |
| 5.3 | Conclusion | 90 |

| | | |
|----------|---|------------|
| 6 | Automatic Macromolecular Docking on Reconfigurable Computers | 91 |
| 6.1 | Macromolecular Docking using Global Correlation | 93 |
| 6.1.1 | Design and Implementation | 94 |
| 6.1.2 | Results | 96 |
| 6.2 | Conclusion | 98 |
| 7 | Conclusion | 99 |
| 7.1 | Results | 99 |
| 7.2 | Analysis | 99 |
| A | Monte Carlo Methods | 101 |
| A.1 | A Review of Monte Carlo Methods | 101 |
| A.1.1 | An Early Monte Carlo Algorithm | 101 |
| A.1.2 | Numerical Integration using Monte Carlo Methods | 102 |
| A.1.3 | Monte Carlo, Beyond Simple Integration | 104 |
| A.2 | A Review of Parallel Pseudorandom Number Generation | 105 |
| A.2.1 | Generating Random Numbers on Deterministic Computers | 106 |
| A.2.2 | Parallel Pseudorandom Number Generation | 108 |
| A.2.3 | Assessing the Quality of Pseudorandom Number Sequences | 110 |
| B | The SRC-6 Reconfigurable Computer | 114 |

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