

High Performance Reconfigurable Computing for Science and Engineering Applications

by

Peter Leonard McMahon

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Advisor: Professor Michael R. Inggs

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.

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