

LITERATURE RECEIVED

EXPLOITING SYMMETRY ON PARALLEL ARCHITECTURES

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We have received copies of Dr. Stiller's Ph.D. thesis awarded to him by the Department of Computer Science of the John Hopkins University, Baltimore, M.D. His thesis advisor was Professor Simon Kasif.

We reproduce the author's abstract:

"This thesis describes techniques for the design of parallel programs that solve well-structured problems with inherent symmetry.

Part I demonstrates the reduction of such problems to generalized matrix multiplication by a group-equivariant matrix. Fast techniques for this multiplication are described, including factorization, orbit decomposition, and Fourier transforms over finite groups. Our algorithms entail interaction between two symmetry groups: one arising at the software level from the problem's symmetry and the other arising at the hardware level from the processors' communication network.

Part II illustrates the applicability of our symmetry-exploitation techniques by presenting a series of case studies of the design and implementation of parallel programs.

First, a parallel program that solves chess endgames by factorization of an associated dihedral group-equivariant matrix is described. This code runs faster than previous serial programs, and discovered a number of new results.

Second, parallel algorithms for Fourier transforms for finite groups are developed, and preliminary parallel implementations for group transforms of dihedral and of symmetric groups are described. Applications in learning, vision, pattern recognition, and statistics are proposed.

Third, parallel implementations solving several computational-science problems are described, including the direct n -body problem, convolutions arising from molecular biology, and some communication primitives such as *broadcast* and *reduce*. Some of our implementations ran orders of magnitude faster than previous techniques, and were used in the investigation of various physical phenomena."

The thesis is available by anonymous ftp from [ftp.cs.jhu.edu:pub/stiller/thesis/thesis-600dpi.ps](ftp://ftp.cs.jhu.edu/pub/stiller/thesis/thesis-600dpi.ps), with a stated restriction that it will only print out properly on 600 dpi printers, for which double-sided printing is recommended. The directory named also contains a file [thesis-300dpi.ps](ftp://ftp.cs.jhu.edu/pub/stiller/thesis/thesis-300dpi.ps), suitable for previewing only.

A hard copy may be more difficult to obtain unless you print it out at your own site. However, the author, as a concession to distributability, is willing to honour requests for printed copies at US \$ 20.00 for each copy so requested. He does not, though, undertake to do so indefinitely.

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