

Topics in Supercomputing

The goal of the project is to study a contemporary topic in supercomputing.

0. A selection of papers

Some browsing through recent issues of *The Journal of Supercomputing* brought up an interesting array of papers we will use as the basis for our second project. Below is a rough classification of the papers. Because of the wide variety of topics, there should be something in there for everybody's taste.

- Optimization: discrete [10], implementing parallel branch and bound algorithms, and continuous [8], using genetic algorithms for computational fluid dynamics.
- Parallel linear algebra: matrix multiplication [11], tridiagonal [12] and iterative solvers [2].
- Differential equations to model heat distribution [5], applied to option pricing, and computational fluid dynamics [9].
- General supercomputing issues: superlinear speedup [1], load balancing [6], scheduling [13], and routing [14].
- Pipelined computations: image processing [3], fast algorithms for addition [4], and application to real-time processing of radar data [7].
- Document retrieval on the web [15]: parallel algorithms for search engines.

As with any literature, these papers cite other papers, feel free to consult these cited sources, or other relevant material. Nevertheless, bear in mind that the literature study is just a starting point.

1. What is the Problem?

Describe in *your own words* the problem addressed in the paper. Provide self contained definitions, referring to concepts we have seen in the textbook. The purpose of this description is that some one who is familiar with our textbook will understand what you wrote without having to consult at any other paper.

What is important in this part of the project is that you make clear you understand the relevance of the problem. One or two paragraphs of text should suffice.

2. The Point of the Paper

What are the results of the authors? What kind of new approaches do they propose? What are their findings? Again, it is most important that you describe the results *in your own words*. When citing an important result (like a theorem), it may be appropriate to use the same wording as in the paper, provided it is made clear that you quote (and not copy) the authors.

In this part of the paper you summarize the contributions of the paper, in one or two pages. Here you should cite the paper and probably also the prior work cited by the authors.

3. Computational Experiments

Can you replicate or simulate the computational experiments done by the authors?

Write your own software or download publicly available programs to experiment whether the timings confirm the analysis in the paper. In particular, try to confirm the computational speedup, analyze the computational and communication ratio for the algorithms discussed in the paper.

As this part of the assignment is rather open ended – and this depends also greatly on the selected paper – the work on this can be extended into a third and final project.

4. The deadline is Monday 27 March 2006 at 1PM.

There is work enough in this project for two, but it also fine if it is solved individually. A collaboration with three could be possible, but is often less productive.

The main deliverable of this project is a written report, complemented with computational results and data. Please provide the source code of your programs as an appendix.

References

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