

PARALLEL COMPUTERS AND PARALLEL ALGORITHMS

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ABSTRACT

The era of serial computation, typified by Von Neumann computers and Turing machines, is coming to an end. Parallel computation is now central to Computer Science, and its importance will increase in the future.

We discuss the motivation for parallel computation (physical constraints on serial computation, biological examples of parallel computation). We describe some practical parallel computer architectures – tightly coupled synchronous machines, loosely coupled asynchronous networks, shared memory and local memory machines, hypercubes and systolic arrays. Concepts such as the *speedup* and *efficiency* of parallel algorithms are defined and illustrated by some examples.

COMMENTS

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REFERENCES

- [1] R. P. Brent, “Parallel algorithms in linear algebra”, *Proceedings Second NEC Research Symposium* (Tsukuba, Japan, August 1991), invited paper, to appear. Available as Report TR-CS-91-06, CSL, ANU, August 1991, 17 pp. rpb128.
- [2] R. P. Brent, “The Linpack benchmark on the AP 1000”, *Proc. Frontiers '92* (McLean, Virginia, October 1992), IEEE Press, 1992, 128–135. ISBN 0-8186-2772-7. rpb130.
- [3] R. P. Brent and P. E. Strazdins, “Implementation of the BLAS level 3 and Linpack benchmark on the AP 1000”, *Fujitsu Scientific and Technical Journal* 29, 1 (March 1993), 61–70. rpb136.

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