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Thurber, K. J., & Wald, L. D. (1975). Associative and parallel processors. *ACM Computing Surveys*, 7(4), 215–255.

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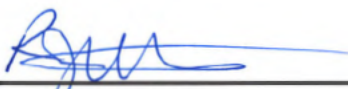
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Associative and Parallel Processors

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This paper is a tutorial survey of the area of parallel and associative processors.
The paper covers the main design tradeoffs and major architectures of SIMD
(Single Instruction Stream Multiple Data Stream) systems. Summaries of
ILLIAC IV, STARAN, OMEN, and PEPE, the major SIMD processors, are
included.

Keywords and Phrases: associative processor, parallel processor, OMEN,
STARAN, PEPE, ILLIAC IV, architecture, large-scale systems, SIMD
processors, array processors, ensemble.

CR Categories: 3.80, 4.20, 6.22

INTRODUCTION

Purpose and Scope

The purpose of this paper is to present a
tutorial survey on the subject of parallel and
associative processors. The paper covers the
topics of system categorizations, applications,
main tradeoff issues, historically important
architectures, and the architectures of systems
that are currently available.

Currently, the microprocessor/computer-on-
a-chip revolution is providing the potential for
production of very cost-effective high-
performance computers through utilization of a
large number of these processors in parallel or
in a network. The parallel and associative proc-
essors provide a class of architectures which can
be readily used to take immediate advantage of
the microprocessor technology.

Surveys

A number of good surveys on the subject (or
bordering on the subject) of parallel and asso-
ciative processors have been published [1-10].
Some of these surveys are only of historical
interest due to their age. Several conferences in
this area may also be of interest [11-14].

Classification of Computer Architectures

Many approaches to classification of computer
architectures are possible. Most techniques use
global architecture properties and are thus valid
only within limited ranges. The main classifica-
tion techniques discussed below provide a
framework within which to view associative and
parallel processors.

Flynn [15] proposed a classification scheme
that divides systems into categories based upon
their procedure and data streams. The four
categories are:

1) SISD (Single Instruction Stream Single
   Data Stream) — a uniprocessor such as a
   single processor IBM 360.
2) MISD (Multiple Instruction Stream Single
   Data Stream) — a pipeline processor such
   as CDC STAR.

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