

Array processor

array processor A computer/processor that has an architecture especially designed for processing arrays (e.g. matrices) of numbers. The architecture includes a number of processors (say 64 by 64) working simultaneously, each handling one element of the array, so that a single operation can apply to all elements of the array in parallel. To obtain the same effect in a conventional processor, the operation must be applied to each element of the array sequentially, and so consequently much more slowly.

An array processor may be built as a self-contained unit attached to a main computer via an I/O port or internal bus; alternatively, it may be a distributed array processor where the processing elements are distributed throughout, and closely linked to, a section of the computer's memory.

Array processors are very powerful tools for handling problems with a high degree of parallelism. They do however demand a modified approach to programming. The conversion of conventional (sequential) programs to serve array processors is not a trivial task, and it is sometimes necessary to select different (parallel) algorithms to suit the parallel approach.

Array processing is a wide area of research in the field of signal processing that extends from the simplest form of 1 dimensional line arrays to 2 and 3 dimensional array geometries. Array structure can be defined as a set of sensors that are spatially separated, e.g. radio antenna and seismic arrays.

Array processors are also known as multiprocessors or vector processors. They perform computations on large arrays of data. Thus, they are used to improve the performance of the computer.

Types of Array Processors

There are basically two types of array processors:

Attached Array Processors

SIMD Array Processors

Attached Array Processors

An attached array processor is a processor which is attached to a general purpose computer and its purpose is to enhance and improve the performance of that computer in numerical computational tasks. It achieves high performance by means of parallel processing with multiple functional units.

Array Processors and its types

SIMD Array Processors

SIMD is the organization of a single computer containing multiple processors operating in parallel. The processing units are made to operate under the control of a common control unit, thus providing a single instruction stream and multiple data streams.

general block diagram of an array processor is shown below. It contains a set of identical processing elements (PE's), each of which is having a local memory M. Each processor element includes an ALU and registers. The master control unit controls all the operations of the processor elements. It also decodes the instructions and determines how the instruction is to be executed.

The main memory is used for storing the program. The control unit is responsible for fetching the instructions. Vector instructions are sent to all PE's simultaneously and results are returned to the memory.

The best known SIMD array processor is the ILLIAC IV computer developed by the Burroughs corps. SIMD processors are highly specialized computers. They are only suitable for numerical problems that can be expressed in vector or matrix form and they are not suitable for other types of computations.

Array Processors and its types

Why use the Array Processor

Array processors increases the overall instruction processing speed.

As most of the Array processors operates asynchronously from the host CPU, hence it improves the overall capacity of the system.

Array Processors has its own local memory, hence providing extra memory for systems with low memory.