

FLEXIBLE MANUFACTURING SYSTEMS

WHAT IS A FLEXIBLE MANUFACTURING SYSTEM ?

Numerically-controlled machines are the first step in the development of much larger systems, containing many such machines and means of conveying work between them. Such systems, when controlled and coordinated by computer, are called *Flexible Manufacturing Systems*, or FMSs. Their advantages over separate machines organised in traditional ways are the coordination possible with unified control, and the potential for keeping track of individual manufactured items so that each can receive individual treatment - the "flexible" of the title.

The components of an FMS can be described in different ways, so different authorities give slightly different lists, which usually turn out to be equivalent. This list is fairly typical :

MANUFACTURING OPERATIONS.

Controllable tools for general manufacturing operations - machining, assembly, etc. - are necessary for making the products. These might be individual machines, elaborate multi-function *machining centres*, or collections of machines arranged as *workcells*.

MATERIALS HANDLING.

Equipment for moving products from place to place, and storing them as required, must be provided. The transporters can be robots (common within workcells), conveyors, automatically guided vehicles, etc. Storage facilities include local buffers to carry short queues of workpieces arriving at, or departing from, machines, and larger storage areas for use to contain moderate sized runs of partly finished products which might build up from time to time, in case of machine breakdown or other unexpected event.

COMPUTER CONTROL.

Supervisory computer systems control the machines and transport to ensure an even flow of work through the system. They take care of scheduling to avoid bottlenecks and stockpiling, rescheduling where possible in case of machine failure, and buffering so that when accidents occur the impact on the plant is minimised.

A diagram (on the next page) shows some examples of components which might be found in an FMS.

The control programme for an FMS is a complex piece of software. Typically, it operates on a distributed system which might contain computers of different types, linked by a communications network. It must keep track of every workpiece in the system, accepting new ones and disposing of completed work, and monitor the state of every machine.

