

FMS PLANNING AND CONTROL

The **planning and control** of a **Flexible Manufacturing System (FMS)** is crucial for ensuring efficient operation, optimal resource utilization, and minimal downtime. It involves decision-making in scheduling, machine loading, tool management, and monitoring production activities.

1. Planning in FMS

A. Process Planning

- Defines the **sequence of operations** required to manufacture a product.
- Determines **machine assignments, cutting parameters, and tool selection.**
- Uses **Computer-Aided Process Planning (CAPP)** for automation.

B. Production Planning

- Establishes **production schedules and batch sizes** based on demand.
- Involves **job sequencing, part routing, and workload balancing.**

C. Capacity Planning

- Ensures that **machines, labor, and material handling systems** are optimally utilized.
- Uses simulation models to predict bottlenecks and optimize performance.

D. Material Requirement Planning (MRP)

- Manages **inventory levels** and ensures the timely availability of raw materials.
- Prevents overstocking or shortages.

E. Tool and Fixture Planning

- Manages **automatic tool changers (ATC) and fixture setups** to ensure smooth production.
- Uses **Computerized Tool Management Systems** to track tool usage and wear.

2. Control in FMS

A. Scheduling and Dispatching

- Determines the **sequence of jobs on machines** to maximize efficiency.
- Uses scheduling techniques like:
 - **First Come, First Served (FCFS)**
 - **Shortest Processing Time (SPT)**
 - **Priority-Based Scheduling**

B. Real-Time Monitoring and Control

- Uses **sensors, IoT, and AI-based systems** to track machine status.

- Helps in **predictive maintenance** and reduces unexpected breakdowns.

C. Material Handling Control

- Controls the movement of parts using **Automated Guided Vehicles (AGVs), conveyors, and robotic arms.**
- Uses **simulation and optimization algorithms** for path planning.

D. Quality Control and Inspection

- Uses **automated inspection systems** such as vision sensors and CMM (Coordinate Measuring Machines).
- Ensures defect-free production and minimizes rework.

E. Data Collection and Analysis

- Uses **Manufacturing Execution Systems (MES)** to collect data on production efficiency, machine downtime, and tool wear.
- Helps in making **data-driven decisions for process optimization.**

Benefits of FMS Planning and Control

- ✓ Reduces production time and costs.
- ✓ Improves resource utilization and efficiency.
- ✓ Enhances quality and consistency.
- ✓ Minimizes downtime and machine failures.