

Towards an Intelligent Manufacturing Enterprise

Research at

Automation and Intelligent Manufacturing Systems (AIMS) Laboratory

University of Oklahoma, Norman.



Manufacturing Execution Systems (MES) play a critical role in today's manufacturing enterprise. In recent years, the globalization of the market place, demands on lower product costs, and the boom in information technology have contributed to the increased use Enterprise Resource Planning (ERP) systems and highly sophisticated manufacturing Process Control Systems (PCS). In most of today's systems, there is no feedback from PCS to the ERP, thereby causing inefficiencies in the utilization of valuable manufacturing resources. These inefficiencies in the operation can result in poor product quality and increased manufacturing costs. Thus, there is a need to integrate the ERP systems with the PCS.

Manufacturing Execution Systems (MES) are designed to bridge this gap between PCS and ERP systems. In order for an enterprise to adapt its manufacturing resources to swiftly changing demand patterns, it requires access to information that permeates all levels of planning, right down to the shop floor. This integration problem is complicated by the presence of a number of legacy production control systems that are not amenable to the tight integration that is required. The integrated information system must seamlessly integrate the PCS and ERP systems and also adapt the business processes and planning logic into the overall system.

The research team at the University of Oklahoma (OU) Automation and Intelligent Manufacturing Systems (AIMS) Laboratory is developing a framework for the integration of MES into existing manufacturing systems. Issues involved in the real-time communications, data acquisition and processing, and interactions between event-driven and continuous-time systems are being addressed and techniques to integrate existing shop floor automation are being researched. The framework developed will then be enhanced by embedding intelligence into the manufacturing enterprise. Embedding intelligence in the manufacturing enterprise will lower the overall life cycle costs by enabling the system to dynamically adapt to changing production schedules and process parameters, reconfigure to meet changing requirements, and increase the system utilization by means of improved diagnostics and fault accommodation.

The OU-AIMS Laboratory has two assembly lines comprising of **Prodel AFP** flexible assembly systems. These assembly lines comprising of manual stations and fully autonomous stations equipped with six-axis, Cartesian, and SCARA robots, have the capability to implement many of the operations common to the assembly of electronic components in the industry. The cell controllers, six-axis robot controllers, and the Ethernet-based network for communicating between different processes make this platform well suited for the development of Intelligent Manufacturing Systems. Successful completion of this project will result in an intelligent manufacturing system design that:

- is predictable and scaleable,
- reduces the manufacturing costs and the cost of ownership,
- improves product quality by increasing visibility and traceability throughout the supply chain, and
- enhances the collaboration with customers, partners, and suppliers.

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