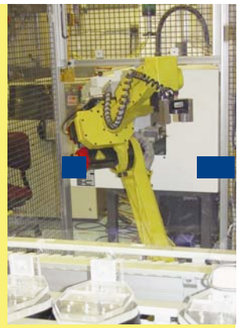

# **Reconfigurable Factory Testbed** (RFT)

University of Michigan

A comprehensive platform enabling research, development, education, validation and transfer of Reconfigurable Manufacturing System (RMS) concepts.

By providing a collaborative mix of hardware/software and real/simulation components distributed across a web-enabled network, the RFT serves as excellent environment to consolidate and showcase results of the University of Michigan's Engineering Research Center for RMS. More importantly, it provides an environment to envision, rapidly prototype, and verify in a factory operation environment those solutions that result from the combination of the RFT components. Further it will provide a mechanism for pre-validation of manufacturing software components to standard specifications.

**For more information, please contact:**

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http://erc.engin.umich.edu/research/thrustareas/TA2.html

## **Reconfigurable Factory Testbed** (RFT)

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UNIVERSITY OF MICHIGAN



3/09

MichiganEngineering

University of Michigan

College of Engineering


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# **Reconfigurable Factory Testbed** (RFT)

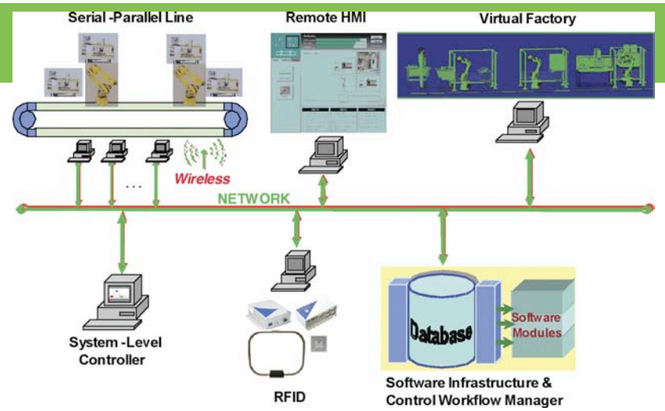
The NSF Engineering Center for Reconfigurable Manufacturing Systems

Established 1996

## RFT Components

The testbed is schematically represented at right. The primary components of the testbed are:

- **Serial-Parallel Line:** This line consists of two cells, each with two table-top CNC machines and a robot, connected in series by a conveyor. This line is utilized in the study of logic control, wired and wireless networks, and other areas related to reconfigurable manufacturing.
- **Software Infrastructure for Consolidated Factory-Wide Control:** Our factory-wide event-based control solution provides a flexible Service Oriented Architecture for control from the enterprise level through cell level. The infrastructure utilizes OPC and XML for communications and a database/ /middleware framework for housing reconfigurable event-driven control rules. This approach is proposed to consolidate controls at all discrete levels of the enterprise to address unscheduled downtime and optimization of factory resources.
- **Multi-tier Networked Control, Diagnostics and Safety Systems:** The RFT employs state-of-the-art industrial technologies for networking of control, diagnostics and safety functionality at multiple levels. At the machine and cell control levels, fieldbus protocols DeviceNet® and ProfiBus® are utilized for distributed control. At higher levels OPC and XML-over-switched Ethernet are used for both diagnostics and control, and a multi-tier SafetyBus® networked safety system provides distributed "smart" safety capabilities. Both the cell control and supervisory layers of the network hierarchy feature wireless networking for control and remote monitoring functions. Further, Radio Frequency Identification (RFID) is integrated for product tracking throughout the RFT.
- **Virtual Fusion:** Various physical parts of the RFT can be replaced by simulations. Both a robot and a cell have been replaced with simulations that run in real time with the RFT. Additionally, an infrastructure is being devised in which simulations will be run in parallel with the RFT and used to monitor and predict process behavior.
- **Remote Viewing and Collaboration Tools:** The RFT employs a remote Human Machine Interface (HMI) to provide connectivity for diagnostics, maintenance, and order placement, utilizing data gathered from sensors/machines using OPC and XML. These web-based tools also give researchers and industry partners access.




## RFT Applications and Benefits

The RFT leverages a multi-disciplinary research team of faculty and students to provide opportunities in the following areas:

### Research

- Wired and wireless networks: quality of performance for controls, diagnostics, and safety; characterizing radio channels in a plant setup and field diagnostic tools.
- Control rules and event-based control: verification and diagnosis of faults in logic control; modular logic control; factory-wide consolidated control strategy.
- Factory-wide fault diagnostics and fault prediction
- Reducing unscheduled downtime through prediction using event data
- "Real + Virtual" Simulation: real-time monitoring; preview interaction with new hardware.
- Network time synchronization (IEEE 1588)
- Combining/collaborating research efforts on a single platform.

### Technology Transfer

- Industrially relevant solutions that utilize off-the-shelf technologies wherever possible, comply with standards (official and de-facto), conform to industry trends, and are guided by industry partners.
- Industry plant pilot studies of developed techniques.
- The RFT provides a facility to showcase solutions (through demonstration and publication), and to demonstrate interoperability among industrial system components.
- Examples of transferred technology include: Software to measure network performance on the factory floor; improved event data collection and analysis process for predicting unscheduled downtime.

### Education

- Modular design allows multiple educational projects to occur simultaneously
- Exposes students to real-world environments and challenges

### Industry Contributors

- ABB
- Brooks Automation
- Chrysler
- Ford
- Fanuc Robotics
- General Motors
- Iconics
- Indusoft
- National Instruments
- NIST
- NSF
- Phoenix Contact
- Pilz Automation
- Rockwell Automation
- Siemens