

Research

EXECUTIVE SUMMARIES : EDITED BY CANDACE YANO

The October issue of IIE Transactions (Vol. 38, No. 10) focuses on design and manufacturing. Below are summaries of two articles from that issue. The first focuses on how to schedule customer orders on flexible manufacturing systems. The second aims to answer the question of how best to implement a system that gives workers a signal to stop the production line to attend to quality problems.

Managing flexible equipment

Flexible manufacturing systems were introduced nearly three decades ago to improve manufacturing efficiency by reducing transfers of parts between machines and the concomitant delays. Each flexible machine is designed to perform many different operations when the necessary tools, devices, and fixtures are installed, so a part needs to visit far fewer machines before it is completed.

Although flexible machines have contributed significantly to productivity and quality, challenges have arisen in managing associated tools, devices, and fixtures, which may cost tens of thousands of dollars. Due to the high cost of flexible machines, a manufacturing facility may have only one or a few of each type, and this means that customer orders must be carefully scheduled to avoid unnecessary setups or changeovers that often take considerable time.

In "Determining Production Sequences for Single-Stage Multifunctional Machining Systems Based on the Tradeoff between Fixture Cost, Re-Fixturing, and Tool Replenishment," David Sinreich and Bernardo Dov Nelkenbaum of the



faculty of industrial engineering and management at the Technion in Israel, develop a method to address these issues. They present a way to determine the best sequence of customer orders that takes into account the tools and fixture type needed for each job type and the tool magazine capacity. The goal is to minimize the total cost of lost time due to setup operations.

The authors have applied their method to problems arising at a manufacturer of medical imaging equipment such as computerized tomography and magnetic resonance imaging systems.

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Implementing an andon

Have you seen flashing lights in a factory? They might be from an andon, an electric light board or other signal

device that is a visible control system seen by everyone. A worker can pull the so-called andon cord, triggering light and music to call for help to adjust a machine or fix a quality defect, for example. Such boards were first used by Toyota and quickly adopted by many Japanese and American manufacturing companies.

There is extensive literature over the past two decades describing and studying andon implementations. Proponents claim that by using andon, productivity is lost due to line stoppage, but overall system performance — the effective production rate of good quality parts — is improved. However, little quantitative analysis has been done to investigate how andon improves product quality and to analyze the trade-offs between quality and productivity.

In "Quantitative Analysis of a Transfer Production Line with Andon," Jingshan Li and Dennis Blumenfeld, staff researchers at the General Motors Research and Development Center, investigate these issues. Some questions they