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Computer Simulation and Decision Making

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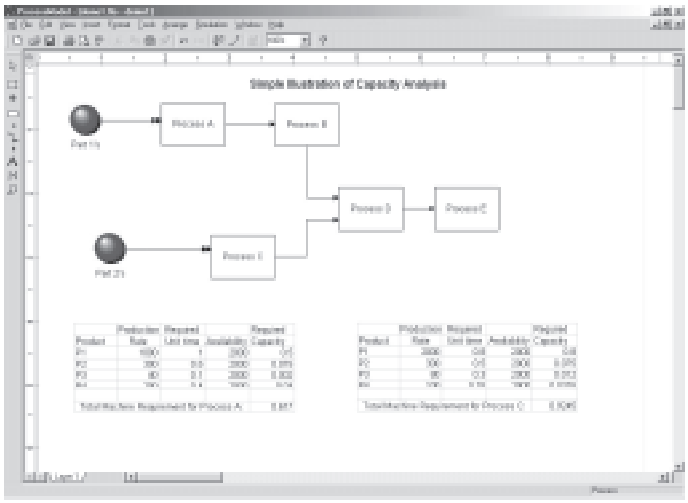

What is computer simulation and modeling? What can it do for you? Why should you be concerned about it? Before answering these questions, let's examine recent CIRAS cases.

Case 1 - The local division of a large tool manufacturer was charged by the home office with reducing their production planning cycle from 21 to 5 days. The plant's manager and engineers developed a solution that involved establishing a new inventory reordering system. However, they were unsure how to set up reorder points and quantities given uncertain product demand and varying lead times.

Case 2 - A major agricultural equipment manufacturer was exploring the feasibility of reengineering their machine shop operation. They wanted to compare the potential benefits of two different strategies.

Case 3 - A wood processing company was considering various plant layout schemes. They needed to know the impact on production capacity and the capital expenditure pay back period for each scheme.

Case 4 - A start-up food processing company was preparing a feasibility study for investors who desired a confidence level prior to their committing to the investment.

Case 5 - Another agricultural equipment manufacturer wanted to implement a new material handling system to improve shop floor productivity and space utilization. They needed to create alternatives and evaluate them.

These companies differed in size and kinds of products produced. They faced different challenges and the economic impact of their actions ranged from several thousand to several millions of dollars. However, they did have something in common. Each was required to evaluate alternative solutions in the face of various uncertainties. If you are a manager, an executive, or a business owner in manufacturing, you can undoubtedly appreciate the difficulty experienced in answering these questions. Fortunately, by employing today's computer simulation studies, these firms were able to increase the odds of making better decisions.

The term *computer simulation* here means a technology that can be used to model the operational behavior of a system such as a manufacturing facility, production process, or service station. Based on the nature of the system, a model can be static or dynamic (influenced by time), deterministic or stochastic (involving randomness), discrete or continuous. Today, simulation is one of the most frequently used system analysis methods. Supported by today's powerful desktop computers and software, it is becoming the tool of choice for evaluating manufacturing systems performance. The benefits offered by this technology include:

Continued on page 2

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CIRAS Mission Statement
The mission of CIRAS is to enhance the performance of Iowa industry, and associated entities, through education and technology-based services.

John Van Engelenhoven

If your company has plans for a new plant, plant layout changes, or a manufacturing process change, computer simulation can be used to assist you in evaluating the change. We do this by first modeling the existing layout or process and then verifying that the model is accurate. Once we have a baseline model of the current layout or process, we can evaluate changes to the model and compare the results with the baseline results. Many factors can be used to evaluate the changes such as cost, distance material is moved, product throughput, etc. If you would like to find out more about computer simulation and how it could assist your company, please give me a call.

Computer simulation

Continued from page 1

- accounts for complex factors and relationships
- shows performance changes over time dynamically
- permits experiments; answers "what if" questions
- evaluates changes without disrupting the actual system
- stimulates ideas and promotes total system optimization
- uses animation for "realistic" representation
- provides cost-effective ways to develop and evaluate system designs

As indicated in the CIRAS cases, computer simulation and modeling of manufacturing systems can be used in:

- manufacturing process design and improvement
- plant layout and material handling
- inventory control and production scheduling
- job shops
- assembly and transfer lines
- JIT, kanbans, and cellular manufacturing scheduling

CIRAS has used this technology to assist companies with various needs, and all have enjoyed benefits.

Making sound systems decisions requires a thorough understanding of the system involved. Computer simulation and modeling can help you understand your system and serve as planning tools to help you manage it. It is to your advantage to use simulation to make decisions about your system.

Benefits

"In short, the whole process of computer simulation from data entry to model construction and operation adds increased degrees of confidence in the benefits to be received from new or modified production systems, and identifies potential problems before they become real problems."
John Annin, President of Parker Industries

"Computer simulation allowed us to develop and test the new concepts for plant layout and material handling before putting it into place. The animation helped our people better visualize and understand the changes that would take place in a new system."
Dave Sly, Founder and President of CIMTECHNOLOGIES

Portable technology facilitates on-site testing

Sunanda Vittal, Engineering Communications and Marketing

Thanks to CIRAS resources and the company assistance programs and research facilities available through Iowa State University, on-site testing of heavy machinery and equipment is a convenient, cost-effective option.

In a recent project with Sukup Manufacturing in Sheffield, Iowa, a combination of CIRAS know-how and state-of-the-art technology from Iowa State worked effectively in educating clients on testing methods and their use in product design.

Sukup, which specializes in agricultural machinery, wanted to test the support structure of its newest product—a stacked continuous-flow grain dryer system.

Over 20 feet in height and length, the system features two dryer units positioned one on top of another. It's innovative patent-pending grain crossover system is designed to minimize over-drying of grain as it moves from one module to another.

Moving the product to a testing lab would have involved elaborate planning and transportation costs. Instead, Sukup did the next best thing. It contacted CIRAS Field Specialist John Van Engelenhoven for assistance, who in turn initiated a convenient, cost-efficient testing process.

First, to help finance the project, Van Engelenhoven connected Sukup with the Center for Advanced Technology and Development (CATD), ISU's technology transfer center. CATD, which assists Iowa companies in developing and commercializing new technologies, proposed a cost-sharing plan that suited the company's budget.

Next, Van Engelenhoven called on resources available in the Engineering Research Lab at ISU's civil and construction engineering department. Equipped with a portable data logger and a compact high-tech electrical device, called a strain gage, ERL Manager Doug Wood, along with a CIRAS team, traveled to Sheffield to perform on-site testing of the structure.

"Strain gages are small electrical grids that when attached to a material can determine its strain level as well as its limitations in withstanding certain loads," said Wood.

Strain gages come in different varieties and sizes ranging from 4 inches to 1/125 inch, explained Wood. The device is comprised of electric wires fixed on a grid that contract and elongate with the deformation of the material. It measures the electric resistance as the wires react to external forces, like pressure, temperature, and structural change in the material.

In this instance, the strain gage was attached to the exterior of the stacked dryer at numerous locations. A laptop and data logger connected to the gages and automatically logged in the data that provided readings for different parameters—from the loading to

Continued on page 4

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Computer simulation

Continued from page 1

unloading of the corn. Additionally, the dryer system was subjected to a simulated lateral load pressure test to determine its resistance to high wind elements.

"Using instruments like the strain gage, the Engineering Research Lab has, in the past, performed other stress tests on a variety of equipment, from wheelchair suspension systems and gymnastic equipment to big wheel trolleys and playground equipment," said Wood.

"In other words, if a company needed research testing while they're designing a new product or even mechanical testing for an existing product, contacting CIRAS can lead to a variety of solutions," added Wood.

Another advantage the CIRAS team provided to the project through CATD assistance was accessing useful benchmarking data of equipment codes and testing standards that have been applied to similar structures in the past.

"The company now has a clearer picture of how much stress their grain dryers will experience under common usage conditions such as carrying substantial grain loads and withstanding extreme weather conditions such as high winds," said Beth Taylor, CATD project manager. "This information will be useful as the firm goes on to design other new products," added Taylor.

Testing a new product for reliability and efficiency is a necessary step that companies undertake to assure customers of their commitment to excellence. CIRAS understands this obligation on the part of manufacturers all too well, which is why its ability to access the latest technology combined with its resource management capabilities invariably gets the job done.