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The importance of process design

By Stephen Giles

I have a dream. In that dream, I am in a cool, white drawing room. I recline on a huge, comfortable sofa, gin and tonic in hand. On three sides of the room, picture windows look out on open, green parkland. The sun is shining, birds sing in the trees, a gentle ripple stirs the clear waters of a lake. On the fourth side of the room there is another picture window. It is to this that my host indicates, saying, "I must do the day's work." He touches a button on the wall. Through the window, the factory springs into life. Raw materials glide seamlessly from the delivery bays straight onto the production line, robots cut, bend, match, assemble, check dimensions, automatic guided vehicles move down the aisles, and finished product, fully packaged, emerges from the production line and onto waiting trucks.

Unrealistic? Probably. The fact is that no amount of automation will ever totally replace human skill and experience. But it is already possible to get pretty close to it by optimising the operating environment before you create it.

What do I mean by this? I am talking about simulation modelling. This is an approach that allows companies to model their processes and assess their effectiveness in different situations before they have been built. The objective is to design any problems out of the system right from the start and ensure optimum results in terms

of throughput, time-to-delivery and the quality of the finished product.

So a company that plans to build a new production line can design it entirely on the computer, visualise each process and try out different "what if?" scenarios. Because it actually shows, on-screen, what may happen, simulation allows users to combine their knowledge and experience with automated analysis tools. The result is that processes really can be optimised before ever they leave the drawing board.

Simulation might, for example, show that bottlenecks could be avoided by changing the order in which processes are carried out, that one model of machine would be more effective than another at carrying out a particular operation, or that using two smaller machines would result in a smoother production throughput than one larger one. Similarly, simulation can determine whether it would be more effective to use skilled technicians rather than machines and the precise way in which those technicians should perform their tasks in order to meet speed and quality targets and avoid physical strain or injury.

More commonly, however, companies need to redesign existing facilities for new products. By using simulation tools, they can create models to visualise and analyse the performance both of the existing processes and of the proposed new ones. They can then make the necessary

changes in the knowledge that production down-time will be kept to an absolute minimum.

Whether it is used to visualise and optimise individual processes, single workcells, production lines or entire factories, simulation modelling ensures smoother production. By identifying possible problems and designing them out of the processes, it ensures:

- A reduction in idle inventory
- Increased machine utilisation
- Faster ramp-up times (and therefore faster new product introduction)
- Reduced down time resulting from the need for process adjustments
- Faster, more streamlined throughput
- Assured return on investment

Simulation modelling is also valuable in transport logistics, where it is absolutely vital to achieve the best possible performance from processes because equipment is expensive and profit margins small. Here, the issues are more likely to centre on the large volumes of materials passing through the system, constantly changing conditions and a high dependency on human resources. By addressing these, simulation modelling helps organisations to minimise time to delivery while ensuring maximum flexibility from the moment that a process or sequence of processes goes on-line. The benefits are:

- Optimisation of the flow of goods
- Easier process management
- A greater ability to predict, avoid or solve possible problems
- Faster, more streamlined throughput

Used in storage, simulation modelling matches products to storage space, calculates the best ways to accept and dispatch orders, optimises access to and retrieval from space and maximises the number of items that can be handled per minute.

The benefits are:

- Best possible access times
- Best possible utilisation of storage space and facilities
- Optimised transport lines
- Optimised use and mix of storage facilities for each consignment

A number of software products claim to offer process simulation and optimisation. The international market leader, which offers the most comprehensive range of capabilities and (probably) the most accurate results, is eM-Plant, from Tecnomatix Technologies.

Based on Monte Carlo mathematical techniques, eM-Plant combines object-oriented models, 3D visualisation and animation, and a wide variety of analysis tools. eM-Plant's design tools allow engineers to create well-structured, hierarchical models of production facilities, lines and processes to visualise even the most complex systems, including advanced control mechanisms. The software's

statistical analysis tools, graphs and charts can then be used to analyse the utilisation of buffers, machines and staff, as well as dynamic situations such as changing line workload, breakdowns and idle and repair time. A bottleneck analyser is also built in, allowing engineers to assess the utilisation of resources and identify bottlenecks and under-worked machines. Sankey diagrams visualise material flow, showing transport volume in the context of the layout. eM-Plant can also generate interactive Gantt charts of the optimised production plans..

Software products such as eM-Plant may never oust the knowledge and experience of people. There is no doubt, however, that they can make people's jobs much easier by taking some of the guess-work out of process design, speeding the decision-making process and bringing the idea of "right first time" one step closer to reality.

When you calculate how much time and effort your company spends on process improvement after the first products have rolled off the assembly line, this can significantly and unnecessarily increase costs. Simulation and optimisation at the design stage can solve the problem and ensure that the process – and the products – are right first time. **●MTEU**

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