

Optimization in Production Process Flow

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Optimization provides a powerful method to quickly search and identify simulation scenarios that yield the desired outcomes. The latest advancements in integrating optimization technology with evaluation techniques that model the complex production process flow environment have contributed to enabling improved and more focused decisions by the diverse set of managers involved in extracting the most value from the factory. Expected benefits from these improved decisions include:

- Increased throughput
- Reduced inventories
- Lower costs
- Increased return on assets
- Reduced lead times
- Greater customer satisfaction

OptTek Systems, Inc., a software and consulting services firm, has developed a powerful method of integrating optimization and evaluation techniques, which, when applied in a factory environment, is capable of guiding a series of simulations to uncover optimal solution scenarios. The uniqueness of its underlying technology, which is based on integrating metaheuristic procedures with classical optimization methods, has resulted in improved outcomes in several thousand real world applications by companies using the software; and most of these applications have involved optimization under uncertainty. And uncertainty is exactly the condition that best describes the factory environment.

To illustrate the application of the method in a typical production process flow environment, consider the following situation in a typical company.

In Company XYZ, predicted volume for factory orders continues to grow. Key managers update their simulation/optimization (OptTek) software to record the increased forecasted volume.

The software provides priority-based resource allocations for planning, managing, and tracking of materials, labor, and equipment. The allocations are established to maximize throughput, minimize raw material costs, minimize work in process inventories, and maximize capacity utilization.

The OptTek software electronically optimizes the schedule scenarios when internal and external environment factors change. Demand shifts in customer orders, plant capacity changes, raw material modifications, and supplier replacement are examples of these changes that can all be adjusted for in the software. The resulting economic rewards:

A confident process for factory production planning and scheduling enables dramatic improvements in customer response time for deliveries, inventory management, throughput, and purchasing and operating expenses. The improvements in overall cycle response times also enable increased market share and higher profitability.

The overall improvement of the process flow planning and management that can be accomplished through the use of optimization methods can be significant. The availability of these new methods opens the door to handling decision-making problems in purchasing, manufacturing, and distribution that could not be adequately approached in the past. OptTek methods empower

decision makers to look beyond conventional decision-making approaches and actually pinpoint the most effective choices in uncertain situations. And it is the first optimization technology to incorporate risk analysis, thus bringing corporate decision-making to a higher level of accuracy. Illustrative applications involve the goals of finding:

- maximum return on budgets allocated to different uses, given uncertain product demand, machine reliability, and raw material availability.
- most effective configuration of machines for production scheduling under variable conditions of demand and operation.
- most effective location and release sequencing of raw materials to minimize waiting time.
- optimal workforce allocations to minimize lead time and labor costs.

In these applications and many others, **OptTek provides decisions and scenarios that are beyond the capability of standard simulation or optimization packages to identify**, and that are essential for effective planning in competitive and uncertain environments. The technology embodied in OptTek's methods represents a successful transfer of cutting-edge research to powerful and practical commercial software.

Practical problems often contain nonlinearities, combinatorial relationships and uncertainties that cannot be modeled effectively by simply listing an objective and a collection of constraints in the "approved mathematical programming manner." Many of these complexities can only be captured by resorting to simulation - an outcome that poses grave difficulties for classical optimization methods. In such situations, typically the only recourse available is to itemize a series of scenarios in the hope that at least one will give an acceptable solution. Consequently, a long-standing goal in both the optimization and simulation communities has been to create a way to guide a series of simulations to produce high quality solutions. Such an objective is essential to cope with the fact that many real world production process flow problems are beyond the solution capabilities of traditional mathematical optimization systems. Recent innovations by OptTek Systems, Inc. have successfully addressed these obstacles and have produced a practical solution integrating metaheuristic procedures with classical optimization methods, which is capable of guiding a series of simulations to uncover optimal or near optimal solution scenarios.