Chapter IX

Intelligent Simulation Framework for Integrated Production System

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Abstract

This chapter addresses the problem of modeling finished products and their associated sub-assemblies and/or raw materials. A production system is a set of policies that monitors and controls finished products and raw materials. It determines how much of each item should be manufactured or be kept in warehouses, when low items should be replenished, and how many items should be assembled or be ordered when replenishment is needed. Practical production models rarely optimize or even represent very precise descriptions of realistic situations. The art of model design is to develop commonsense approximations that give enough information to facilitate managerial decision-making. A system with a high degree of intelligence is more robust and able to perform better in terms of lower cost and higher efficiency. The integration concept of manufacturing processing has enjoyed increased popularity among researchers and manufacturers. Integrated production system is a set of mathematical models and policies that monitors and controls raw items, sub-assemblies,
and finished products. Although such systems provide a better utilization of resources they have a number of drawbacks due to the complexity of real world problems. Using intelligent simulation techniques will lead to better automated systems.

Introduction

Before starting the discussion of intelligent systems, one needs to introduce a number of terms, including modeling. A model may be viewed as a representation of real life activities while a system can be viewed as a section of reality. A common property of all physical systems is that they are composed of components that interact with one another. The physical laws that govern their behavior determine the nature of the interactions in these systems.

A system, in our case, is an organized group of entities, such as people, equipment, methods, principles, and parts, which come together and work as one unit. A simulation model characterizes a system by mathematically describing the responses that can result from the interactions of a system’s entities.

The set of values of variables in a system at any point in time is called the state of the system at that point in time.

System state is the collection of variables, stochastic (can change randomly) and deterministic (not influenced by probability), which contain all the information necessary to describe a system at any point in time.

A discrete event is an instantaneous action that occurs at a unique point in time. A part arriving at a delivery dock, a customer arriving at a bank, and a machine finishing a cycle of production are examples of discrete events. A continuous event continues uninterrupted with respect to time. The temperature of water in a lake raising and lowering during a day, the flowing of oil into a tanker, and chemical conversions are simple examples (Turban, 2001).

Simulation is not strictly a type of model. Models in general represent reality, whereas simulation typically imitates it. Simulation is a technique for conducting experiments. To simulate means to assume the appearance of the characteristics of reality. Simulation involves testing specific values of the decision or uncontrollable variables in the model and observing the impact on the output variables. Simulation is usually used only when a problem is too complex to be treated by numerical or analytical optimization techniques (Bowswell, 1999).

Steady State

A steady state simulation implies that the system state is independent of its initial start-up conditions. Analyses of these models are based on output data generated after the steady
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