Preface: Introduction to Special Issue

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Demands for flexibility, greater variety of products, and advanced production processes complicate the logistics and planning of manufacturing systems; this also increases the number of alternatives that should be formalized in a model.

The evaluation of all the possible alternatives of the planning problem is often considered an NP-hard combinatorial problem. Practical problems often contain nonlinearities, combinatorial relationships, and uncertainties that cannot be easily formalized under mathematical predefined relationships, binding the use of most commercial optimization toolboxes.

Despite the fact that simulation models have proved to be useful for examining the performance of alternative system configurations and/or alternative operating procedures, several limitations arise when simulation techniques are applied to improve logistic systems performance due to its inability to evaluate more than a fraction of the immense range of options available.

This special issue is the second of two issues that focus on the use of simulation techniques to improve manufacturing and logistic systems performance. Papers published in the first issue (Volume 80, Number 3) were mainly related to new modeling and simulation methodologies to improve logistic and manufacturing systems performance. Papers and technical notes in this second issue are focused on illustrating the use of experimental models to improve the performance of manufacturing and logistic systems by means of case studies.

The article “A Petri Nets–Based Scheduling Methodology for Multipurpose Batch Plants’’ presents an optimization methodology of batch production processes assembled by shared resources that rely on a mapping of state events into time events, allowing in this way the straightforward use of well-consolidated scheduling policies developed for manufacturing systems. A technique to generate the timed Petri net representation from a continuous dynamic representation (differential algebraic equation [DAE] systems) of the production system is presented together with the main characteristics of a Petri nets–based tool implemented for optimization purposes.

The article “A Simulation Study for Implementing Color Rescheduling Storage in an Automotive Factory’’ outlines a simulation study relating to the design and implementation of color rescheduling storage (CRS) in an automotive factory. The procedure for designing CRS is explained, and the storage/retrieval algorithms are suggested. The proposed system is verified using simulation models, and comparisons among alternatives are examined to determine the best design.

The article “Exploring Alternatives in an Automotive Industry Job Shop Using Simulation’’ illustrates the benefits of using simulation techniques in a field of automotive suppliers where simulation is scarcely used due to the high initial costs, the political inertia among managers, or both. In this case study, the introduction and use of discrete process simulation into an automotive component supplier for the examination of various plausible scenarios whose effects production engineers and their management wished to anticipate is presented.

The technical note, “Agent Directed HLA Simulation for Complex Supply Chain Modeling,’’ outlines a new modeling methodology designed to simulate complex logistics networks and to ensure interoperability through application of the Intelligent Agent High-Level Architecture for distributed supply chain management.

Finally, the technical note “Optimizing the Operation of a Toll Plaza System Using Simulation: A Methodology’’ provides a detailed study and analysis of the performance evaluation of a toll plaza using discrete event simulation modeling. A comparative performance analysis of different types of tollbooth configurations has been conducted to optimize the best configuration.