

SIMULATION OF MANUFACTURING SYSTEMS

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ABSTRACT

This paper discusses how simulation is used to design new manufacturing systems and to improve the performance of existing ones. Topics to be discussed include: manufacturing issues addressed by simulation, simulation software for manufacturing applications, techniques for building valid and credible models, and statistical considerations. A comprehensive example will be given in the conference presentation.

1 INTRODUCTION

One of the largest application areas for simulation modeling is that of manufacturing systems, with the first uses dating back to at least the early 1960's. In this paper we present an overview of the use of simulation in the design and analysis of manufacturing systems. Detailed discussions of simulation, in general, may be found in Banks, Carson, and Nelson (1996) and Law and Kelton (1999). A practical discussion of the steps in a sound simulation study is given in Law and McComas (1990). This paper is a synopsis of a three-day short course with the same title as this paper, which the first author has given more than fifty times since 1985.

2 MANUFACTURING ISSUES ADDRESSED BY SIMULATION

The following are some of the specific issues that simulation is used to address in manufacturing:

The need for and the quantity of equipment and personnel

- Number, type, and layout of machines for a particular objective
- Requirements for transporters, conveyors, and other support equipment (e.g., pallets and fixtures)

- Location and size of inventory buffers
- Evaluation of a change in product volume or mix
- Evaluation of the effect of a new piece of equipment on an existing manufacturing system
- Evaluation of capital investments
- Labor requirements planning
- Number of shifts

Performance evaluation

- Throughput analysis
- Time-in-system analysis
- Bottleneck analysis

Evaluation of operational procedures

- Production scheduling
- Inventory policies
- Control strategies [e.g., for an automated guided vehicle system (AGVS)]
- Reliability analysis (e.g., effect of preventive maintenance)
- Quality-control policies

The following are some of performance measures commonly estimated by simulation:

- Throughput
- Time in system for parts
- Times parts spend in queues
- Queue sizes
- Timeliness of deliveries
- Utilization of equipment or personnel

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aforementioned problem at the atomic level This requires large computational aids and computational time which makes the development of economical calculation methods urgent The objective of this volume is the development of such a technique in various nanosystems *Proceedings of the 31st Conference on Winter Simulation Simulation---a Bridge to the Future - Volume 2* Winter Simulation Conference 1999,1999 *Proceedings of the ... Winter Simulation Conference* ,2002

Automation and Robotics Juan-Manuel Ramos-Arreguin,2008-05-01 In this book a set of relevant updated and selected papers in the field of automation and robotics are presented These papers describe projects where topics of artificial intelligence modeling and simulation process target tracking algorithms kinematic constraints of the closed loops non linear control are used in advanced and recent research **Biomedical Engineering & Design Handbook, Volumes I and II** Myer Kutz,2009-07-13 A State of the Art Guide to Biomedical Engineering and Design Fundamentals and Applications The two volume Biomedical Engineering and Design Handbook Second Edition offers unsurpassed coverage of the entire biomedical engineering field including fundamental concepts design and development processes and applications This landmark work contains contributions on a wide range of topics from nearly 80 leading experts at universities medical centers and commercial and law firms Volume 1 focuses on the basics of biomedical engineering including biomedical systems analysis biomechanics of the human body biomaterials and bioelectronics Filled with more than 500 detailed illustrations this superb volume provides the foundational knowledge required to understand the design and development of innovative devices techniques and treatments Volume 2 provides timely information on breakthrough developments in medical device design diagnostic equipment design surgery rehabilitation engineering prosthetics design and clinical engineering Filled with more than 400 detailed illustrations this definitive volume examines cutting edge design and development methods for innovative devices techniques and treatments Volume 1 covers Modeling and Simulation of Biomedical Systems Bioheat Transfer Physical and Flow Properties of Blood Respiratory Mechanics and Gas Exchange Biomechanics of the Respiratory Muscles Biomechanics of Human Movement Biomechanics of the Musculoskeletal System Biodynamics Bone Mechanics Finite Element Analysis Vibration Mechanical Shock and Impact Electromyography Biopolymers Biomedical Composites Bioceramics Cardiovascular Biomaterials Dental Materials Orthopaedic Biomaterials Biomaterials to Promote Tissue Regeneration Bioelectricity Biomedical Signal Analysis Biomedical Signal Processing Intelligent Systems and Bioengineering BioMEMS Volume 2 covers Medical Product Design FDA Medical Device Requirements Cardiovascular Devices Design of Respiratory Devices Design of Artificial Kidneys Design of Controlled Release Drug Delivery Systems Sterile Medical Device Package Development Design of Magnetic Resonance Systems Instrumentation Design for Ultrasonic Imaging The Principles of X Ray Computed Tomography Nuclear Medicine Imaging Instrumentation Breast Imaging Systems Surgical Simulation Technologies Computer Integrated Surgery and Medical Robotics Technology and Disabilities Applied Universal Design Design of Artificial Arms and Hands for Prosthetic

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Optimizing Supply Chains Through Digital Twins Ghaith Rabadi, Bulent Soykan, 2026-01-01 This book serves as a comprehensive resource offering valuable insights into the application of Digital Twins in supply chain management It covers foundational concepts of supply chain optimization and delves into the technological frameworks that enable the integration of Digital Twins Contributions from leading academics industry experts and researchers provide a multi dimensional perspective on this transformative approach Real world case studies are included to showcase the practical benefits and challenges of implementing Digital Twins in various segments of modern supply chains from manufacturing and distribution to inventory management A set of practical guidelines and best practices for implementing Digital Twins in supply chain management round out the content The book offers a roadmap for organizations looking to adopt this technology for enhanced operational efficiency To deepen the reader s understanding it also features specialized sections on data security and ethical considerations when implementing Digital Twins in supply chains By covering these aspects it offers the go to resource for a wide range of professionals including supply chain managers data scientists and IT specialists as well as academics researchers and students in related fields who are looking to understand or implement Digital Twins in the context of supply chain optimization

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