

EcoProduction

Environmental Issues in Logistics and Manufacturing

Series editor

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The EcoProduction Series is a forum for presenting emerging environmental issues in Logistics and Manufacturing. Its main objective is a multidisciplinary approach to link the scientific activities in various manufacturing and logistics fields with the sustainability research. It encompasses topical monographs and selected conference proceedings, authored or edited by leading experts as well as by promising young scientists. The Series aims to provide the impulse for new ideas by reporting on the state-of-the-art and motivating for the future development of sustainable manufacturing systems, environmentally conscious operations management and reverse or closed loop logistics.

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FlexSim in Academe: Teaching and Research

 Springer

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ISSN 2193-4614

ISSN 2193-4622 (electronic)

EcoProduction

Environmental Issues in Logistics and Manufacturing

ISBN 978-3-030-04518-0

ISBN 978-3-030-04519-7 (eBook)

<https://doi.org/10.1007/978-3-030-04519-7>

Library of Congress Control Number: 2018961709

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The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Simulation is emerging as an important tool to support the decision-making and problem-solving processes that are inherent in the design, management, and improvement of numerous types of operations systems, including manufacturing, logistics, healthcare, etc. Currently, simulation is one of the key technologies within the framework of the 4.0 Industry concept. This concept defines a new organization of factories (called intelligent factories), allowing for better customer service through enormous flexibility and resource optimization. The key principles of the Industry 4.0 are as follows:

- the factory becomes digital and flexible, which means continuous and immediate communication between various workstations and tools, integrated into production lines and supply chains;
- the use of simulation tools and data processing to collect and analyze data from assembly lines that are used for modeling and testing; this is a great value for employees who want to better understand industrial conditions and processes;
- the factories become more economical in using energy and resources through the use of communication networks to exchange information in a continuous and immediate way to coordinate the needs and availability.

Simulation is a collection of methods and techniques, which includes: discrete simulation, continuous simulations (including systems dynamics), Monte Carlo method (including static simulations in a spreadsheet), managerial games, qualitative simulation, agent simulation, and others.

FlexSim is a leading simulation software; its power includes integrated 3D modeling for realistic physical representations, an open and easily customized model development environment, and process-based logic building for specifying complex system behaviors and object interactions. As a result, there is a growing need to effectively educate a wide range of students on at least the basic concepts and power of simulation and disseminate advances in research and application.

The goal of this book is to present, expand, and enhance the use of simulation in general, and FlexSim in particular, in academe through teaching and research. This book gives the opportunity to share ideas and practices.

The book consists of three parts *Introduction*, *Teaching* and *Research*. It is preceded by a chapter describing the experience obtained from many years of work with FlexSim at the Poznań University of Technology in Poznań, Poland. This chapter demonstrates how the use of FlexSim software in the specified areas contributes to the development of competences for the Industry 4.0.

Part II of the book which focuses on teaching aims to answer some important questions, which are as follows:

- How to effectively design and manage simulation course projects, both from the educator's and student's perspectives?
- How to teach with success new skills?
- How to increase high school students' interest in industrial engineering through a summer camp?

Part III of the book presents the application of the simulation software in research and it focuses mainly on:

- an implementation of 3D Discrete Event Simulation (DES) in an offshore manufacturing foundation process to increase the efficiency of the process by reducing costs and delivery times,
- an innovative parametric decision model designed by applying 3D Discrete Events Simulation (DES) concepts and customized to be applicable in offshore wind turbine foundations manufacturing plant,
- the methodology of modeling and simulation of human operators and industrial robots,
- the method of designation of the optimal number of trailers for milk-run system,
- an implementation of the calculation results about number of trains, trailers, and routes into the simulation model,
- using Constraint Satisfaction Problems solvers as alternative to simulation optimization engines.

Although not all of the received chapters appear in this book, the efforts spent and the work done by the authors are very much appreciated.

We would like to thank all reviewers whose names are not listed in the volume due to the confidentiality of the process. Their voluntary service and comments helped the authors to improve the quality of the manuscripts.

This scientific monograph has been peer-reviewed.

Poznań, Poland

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