Leveraging Modelling and Simulation to address Manufacturing Challenges

Publisher: IEEE

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Abstract:

The diverse range of simulation and modelling (s&m) encompasses all aspects of the society, military, and economy particularly the major fields of endeavour that are germane to national development and national security, for example, health care, aviation, information technology, manufacturing, transportation, education, and agriculture. nonlinearity, uncertainty, and high complexity of the research objectivity are collective feature fields. as digital technologies are transforming manufacturing, ranging from product design, planning, and scheduling, to life cycle assessment of the products. emerging technologies have remarkably increased the impact of modelling and simulation. the manufacturing industry has started to incorporate enhanced methodologies toward the interdependent systems that aid accurate decision making and actual depiction of the digital world entities. modelling and simulation have demonstrated unique and cutting-edge advantages in the field of manufacturing. in this paper, we critically examined works of literature on the simulation and modelling of manufacturing systems, areas of application in the manufacturing industry, and challenges associated with modelling and simulation.

Published in: 2023 International Conference on Science, Engineering and Business for Sustainable Development Goals (SEB-SDG)

Date of Conference: 05-07 April 2023

Date Added to IEEE *Xplore*: 22 May 2023

ISBN Information:

INSPEC Accession Number: 23199906

DOI: 10.1109/SEB-SDG57117.2023.10124595

Publisher: IEEE

Conference Location: Omu-Aran, Nigeria

I. Introduction

After several decades of development, modelling, and simulation technology have become another vital means of bringing transformation into the world asides from experiments and theories[1]. The diverse range of simulation and modelling (S&M) encompasses all aspects of the society, military, and economy particularly the major fields of endeavour that are germane to national development and national security, for example, healthcare, aviation, information technology, manufacturing, transportation, education, and agriculture[2]. Nonlinearity, uncertainty, and high complexity of the research objectivity are collective feature fields. Some of these systems possess qualitative and quantitative characteristics that are both discrete and continuous concurrently[3]. These features make it daunting to carry out systematic comprehensive research via the traditional research methodology. This makes the application of applying S&M the necessary option in researching the system's complexities and critical problems; S&M technology has demonstrated distinctive advantages. The S&M application in the manufacturing industry can be dated back to the 1950s, despite the numerous years of development, its application has expanded to nearly every facet of the product life cycle(PLC) encompassing product design and manufacturing, product testing, and maintenance, distribution, sales, and after-sales services[4]. Presently, S&M portrays a vital role in the manufacturing industry. The incorporation of information technology with manufacturing systems is gradually evolving into digitalization,

collaborative, personalization, intelligent, and service-oriented systems[5] [6]. Also, the increasing need for S&M technology in the manufacturing sector is overwhelming. The development of S&M technology differs on the country, size of the companies, type of industry, and the functions involved[7].

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Keywords

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