

Editorial

Decision Making Problems Related to Modular Design Practices or Techniques

Vladimir Modrak ¹, **R. Sudhakara Pandian** ², **Ponnusamy Venkumar** ³
and **Chrysostomos Stylios** ⁴

¹Dept. of Industrial Engineering & Informatics, Institute of Manufacturing Management, Technical University of Kosice, Kosice, Slovakia

²Dept. of Manufacturing Engineering, School of Mechanical Engineering, Vellore Institute of Technology, Vellore, India

³Dept. of Mechanical Engineering, VSB Engineering College in Karur, Affiliated to Anna University in Chennai, Chennai, India

⁴Dept. of Informatics & Telecommunications, University of Ioannina, Ioannina, Greece

Correspondence should be addressed to Vladimir Modrak; vladimir.modrak@tuke.sk

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Modularization, often treated as modular design, is a well-known approach subdividing a system or product or process into smaller parts called modules. These design elements are engineered to be grouped collectively so that a single module can be developed, modified, replaced, or swapped between other systems. Modular design is widely used in multiple disciplines, including the theory of interrelatedness and reconfigurability, axiomatic design theory, general modular systems theory, graph theory, complexity science, and system theory. System theory, as one of the major meta-synthetic disciplines, describes modular systems using mathematical concepts in the most generic way. In spite of its prevalence and importance for flexible systems or product or process development and improvement, there is still insufficient understanding of how to apply existing knowledge and techniques of modular design in specific application domains. In order to contribute to overcoming the situation, this Special Issue collects recent original contributions related to designing products, optimization models for decision making problems, process modularity, and manufacturing systems modularity.

Authors from five different countries submitted original research articles that made use of mathematical methodologies and tools, numerical solutions, computer programmes, and data handling procedures to cover, explicitly or implicitly, the defined and relevant subject fields.

Contributions containing generalized formulations or results related to practical applications are also included.

This Special Issue has received more than ten manuscripts, from which eight of them complied with essential editorial requirements screened by members of the journal's Editorial Board, and five high-quality papers have been accepted and published. The published papers have addressed various real-time techniques and contributed to a wide range of application areas such as modelling of assembly process structures, designing of large-scale box structures, performance optimization in manufacturing systems, and causal reasoning in decision making. A brief description characterizing each contribution is provided in the following paragraphs.

G. Mazzuto et al. investigated and proposed a novel hybrid decision-support system based on the decision-making trial and evaluation laboratory and fuzzy cognitive maps. Their method increases decision makers' ability to make correct decisions, since it enables them to more effectively differentiate and understand system findings. The applicability and advantage of this approach are illustrated there through a case study focused on analysis of clinical risk in drug administration. Obtained results clearly show a promising potential of the proposed method for achieving better decision outcomes than by using traditional fuzzy cognitive mapping methodology.

The authors V. Modrak and Z. Soltysova stated about the assessment of the degree operational modularity issues. A novel approach of this research lies in measuring the relative modularity of various assembly process topologies. In order to validate its effectiveness, this novel technique is compared to other relative modularity metrics such as the single value modularity index, degree of process module, and process module independence. The expected result for the relative modularity indicator in the manufacturing assembly process structure is obtained using the new technique.

W.-Y. Wang and Y. Wang, in their article, discussed the development of a diagnostic index system for large-scale building projects. The indicators produced in this work are more structurally correlated than current index systems, with superior hierarchical development at all levels of the index system. It has been shown that the diagnosis index system generated by the recommended approach is capable of diagnosing macroscopic, mesostates, and microstates, as well as expressing systematic hierarchical linkages among all linked indices.

The paper written by Velmurugan et al. focuses on development and implementation of the new method to predict the most critical subsystems in the tyre manufacturing system of the rubber industry. Their research was motivated by the fact that any one maintenance parameter among reliability, availability, maintainability, and dependability parameters was not mathematically evaluated to identify the critical subsystems and their impact on the effectiveness of the tyre manufacturing system. In order to fill this research gap, this paper proposes an approach to identification of the critical subsystem of the tyre production system based on the Markov Birth Death approach. Besides, it also includes calculation of the performance of certain maintenance parameters concerning time such as mean time between failures, mean time to repair, and dependability ratio for each subsystem of the tyre production system.

Z. Wang et al. discussed various concerns of direct topology optimization as a result of large-scale box structure carrying moving loads by the primary load bearing structure of heavy machine tools, cranes, and other high-end types of equipment. As a result, for large-scale box structures, the authors presented multiworking condition topology optimization. For instance, using a crossbeam from a super-heavy turning and milling machining centre, the optimization study shows that the crossbeam's stiffness and strength are enhanced while its weight is minimized.

We would like to conclude this editorial with the hope that the collection of the papers in this Special Issue will be beneficial to readers who are scientifically interested or practically involved in decision making problems related to modular design practices or techniques.

Conflicts of Interest

The editors declare that there are no conflicts of interest regarding the publication of this article.

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*Vladimir Modrak
R. Sudhakara Pandian
Ponnusamy Venkumar
Chrysostomos Stylios*