
GUEST EDITORIAL

Special Issue: Platform product development for mass customization

GEORGE HUANG,¹ ROGER JIAO,² AND MITCHELL M. TSENG³

¹Department of Industrial and Manufacturing Systems Engineering, University of Hong Kong, Pokfulam Road, Hong Kong

²School of Mechanical and Production Engineering, Nanyang Technological University, Nanyang Avenue 50, Singapore 639798

³Department of Industrial Engineering and Engineering Management, Hong Kong University of Science and Technology, Clearwater Bay, Hong Kong

Platform product development is a contemporary approach to agile product development for mass customization. Distinctive product variants are derived or customized from a platform that is defined as components and subsystems commonly shared across a product family. A well-organized platform is essential to connect different parties of an enterprise including soliciting customer needs through order fulfillment to field service. Hence, it is also critical to achieve the economy of scale by identifying repetitive applications of share tooling, knowledge, and other resources. In this Special Issue, we attempt to cover the different aspects of platform product development. The topics span a wider range of artificial intelligence (AI) disciplines, from knowledge representation to knowledge support systems. It identifies a fertile area not only for applying AI to contemporary issues of design and manufacturing systems but also for enriching the methodology for developing AI systems in manufacturing enterprises. Indeed, we consider that numerous successful applications in the industrial sectors highlight a future direction for productive AI applications in industry.

Six papers have been selected for publication in this Special Issue to take a snapshot of the research progress and to disseminate recent developments in decision support systems for platform product development. The first paper, by Simpson, is a comprehensive literature review, which substantially extends this editorial discussion about approaches and techniques of platform product development for mass customization. Techniques for identifying platform leveraging strategies within a product family are reviewed along with metrics for assessing the effectiveness of product platforms and product families. Special emphasis is placed on optimization approaches and AI techniques to assist in the process of product family design and platform-based prod-

uct development. Web-based systems for product platform customization are also discussed.

The second paper, contributed by Corbett and Rosen, presents computational methods for modeling and combining design spaces from which configurations that satisfy all constraints can be identified. A new representation of assembly sequences facilitates the development of an assembly design space whose elements can be readily enumerated. Configuration design focuses on the components in a product and their connections and relationships. Discrete, combinatorial design spaces are used to model design requirements regarding physical connections, module partitions, and assembly sequences for the product family.

The third paper, by Germani and Mandorli, presents a framework and prototype system architecture to support the design process for a configurable product. The basic idea is to develop highly reusable models, which are able to reconfigure themselves on the basis of new functional requirements. The proposed framework is based on the concept of *self-configuring components*. They are related to each other by means of provided or requested functions. Each function is further defined at different levels of detail (*multiple-level function*) to represent the knowledge evolution during the different phases of the design process.

The fourth paper, by Hofer, examines three industry case studies in which a product family is based on a common layout. This layout platform standardizes the arrangement of subsystems within the family of complex products and systems. The employment of layout platforms leads to substantial complexity reduction, offers considerable freedom in design, and is the basis for competitive advantage. The concept imposes a dominant design on a product family, improves its configurability, and supports effective market segmentation.

The fifth paper, by Siddique and Boddu, presents a framework in which customer options and size parameters are gathered on the Internet for automatically generating an

Reprint requests to: Dr. George Huang, Department of Industrial and Manufacturing Systems Engineering, University of Hong Kong, Pokfulam Road, Hong Kong. E-mail: gqhuang@hku.hk

appropriate three-dimensional computer-aided design model of the product, estimating its price, and generating its assembly sequence. The resulting Internet-based system is based on a graph grammar and on templates. It explicitly maintains correspondence between various pieces of product information from a module perspective and thus facilitates information management among different segments of the company and the customer. The system is demonstrated using a customizable coffeemaker product family.

The sixth and final paper, by Zha, Sriram, and Lu, is focused on the development of a knowledge intensive support scheme and a comprehensive systematic fuzzy clustering and ranking methodology for the evaluation and selection of product family designs in the mass customization context. The resulting decision support deals with imprecision inherent in decision making with fuzzy customers' preference relations, and it carries out fuzzy analy-

sis for product family evaluation and selection. A neural network technique is also adopted to adjust the membership function to enhance the model. A case study is discussed to illustrate the scenario of knowledge support for power supply product evaluation, selection, and customization.

The editorial team thanks the authors for contributing their papers to this Special Issue and for incorporating the referees' comments when revising their manuscripts. Each paper accepted in this Special Issue was read by at least three independent reviewers in two rounds, apart from the Guest Editors. Special thanks are extended to the referees for giving their valuable comments on the papers.

Finally, the Guest Editors express thanks to Professor David Brown, Editor In Chief of *AIEDAM*, for his advice, patience, and support during the process of collating this Special Issue.