Preface for the special issue of TMCE 2016 International Symposium on Tools and Methods of Competitive Engineering
New utilizations of geometric knowledge in product engineering

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This special issue, entitled *New utilizations of geometric knowledge in product engineering*, encompasses a selection of high-quality articles presented at the International Symposium on Tools and Methods of Competitive Engineering (TMCE 2016) which was held in Aix-en-Provence, France, in May 2016. This multidisciplinary symposium featured a couple of sessions which dealt with various issues of using knowledge and semantic information to support geometric treatments within the product lifecycle.

The article entitled *A framework for negative knowledge to support hybrid geometric modeling education for product engineering* contributes to the topic of CAD education. Harald E. Otto and Ferruccio Mandorli propose an interesting approach based on the integration of traditional teaching methods with an educational approach based on negative knowledge. Analysis of the first empirical results of this newly developed approach showed promising results. Improvements have been observed in understanding issues related to the usability of CAD models and an increased capability to recognize critical modeling situations and thus prevent the mistakes typically made by novices.

In the next article, Michael Leitcha, Yishak Yusufa and Yongsheng Ma propose an *Interdisciplinary semantic model for managing the design of a Steam-Assisted Gravity Drainage (SAGD) tooling system*. A software modeling framework is presented, which helps manage the design process of the production tools used for SAGD oil extraction. The proposed Cyber-Physics System (CPS) model combines effective simulation with embedded knowledge of completion tooling design in order to optimize reservoir performance.

Another article, entitled *Leveraging 3D geometric knowledge in the product lifecycle based on industrial standards*, analyses the methods and tools used in virtual product development to provide 3D CAD data in the entire lifecycle. Alain Pfouga and Josip Stjepandić present a set of versatile concepts for mastering exchange, aware and unaware visualization and collaboration from single technical packages.

In their article entitled *Multi-criteria retrieval of CAD assembly models*, Katia Lupinetti, Franca Giannini, Marina Monti and Jean-Philippe Pernot propose a method to characterize and structure CAD assembly models. The objective is to enable retrieving of globally and/or partially similar models from a database. It is based on a new assembly descriptor, called the Enriched Assembly Model, which is an attributed graph that encodes all the required data automatically extracted from the geometry and structure of the CAD models. The matching between two assembly models is translated into the problem of finding a sub-isomorphism between two EAMs.

Alain-Jérôme Fougères and Egon Ostrosi have contributed to this special issue with their article on *Intelligent agents for feature modeling in computer aided design*. Their work introduces the intelligent agents in intelligent CAD modeling. The proposed agents are elementary geometrical and topological objects. They are modelled as bio-dynamic objects that realize the properties of fusion, division and multiplication. Being aware of their belonging in a region, agents can interact and generate virtual extension. The emerged agents interact with the other agents in a region to recognize each other and to form specific sub-communities, called intelligent features.

The next paper, entitled *An additive manufacturing oriented design approach to mechanical assemblies*, introduces a new top-down assembly design methodology for Additive Manufacturing which allows the design of assemblies to be manufactured with a few or even no assembly operations. This novel approach provides assistance in the definition of the product architecture so that both functionality and successful manufacturing (including post-processing) are ensured.

According to our insights gained, the special issue delivers six articles on the interesting topic of new utilizations of geometric knowledge in product engineering, which is of paramount

importance for competitive engineering. We are grateful to all authors for their contribution to this special issue, and we do appreciate their patience and collaboration. We are also indebted to our peer reviewers, who helped increase the scientific/ professional value and quality of the articles.

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