Preface

Cloud-Based Design and Manufacturing (CBDM) refers to a new service-oriented product realization paradigm for the twenty-first century in the broader context of distributed and collaborative product development. CBDM fosters knowledge and resource sharing as well as highly efficient rapid product development with reduced cost through social networking and negotiation platforms that exist between service providers and consumers. A design and manufacturing cloud is a collaborative and distributed system consisting of a collection of interconnected physical and virtualized service pools of design and manufacturing resources, as well as associated search and retrieval capabilities. CBDM systems are anticipated to become the backbone of future intelligent and semantics-based Web 3.0 applications for design and manufacturing in the broader context of Social Product Development.

The purpose of this book is to provide an introductory overview of one of the most topical developments in the context of advanced design and manufacturing.

As the title suggests, "Cloud-Based Design and Manufacturing: Status and Promise" gives an overview of the current status and promise of CBDM. First, Wu et al. introduce their definition and vision of CBDM. This is followed by a discussion of the characteristics of CBDM systems as well as the similarities and differences between CBDM and more traditional paradigms, such as web- and agent-based approaches. The chapter continues with the presentation of a CBDM prototype system developed at Georgia Tech and concludes with an outline of current and future research directions in the context of CBDM.

"Multi-User Computer-Aided Design and Engineering Software Applications" discusses multi-user Computer-Aided Design and Engineering software applications as a new paradigm for product development, considering past collaborative research and the emerging wave of cloud-based social and gaming tools. Red et al. consider how multi-user architectures will change the single-user paradigm from serial to simultaneously collaborative, promote new on-demand access methods like cloud serving, and bring long hoped for efficiencies to product development.

In "Distributed Resource Environment: A Cloud-Based Design Knowledge Service Paradigm", a cloud-based design knowledge service paradigm is introduced. Zhang et al. propose a distributed resource environment, which enables companies to utilize collective open innovation and rapid product development with reduced cost. Definition, functionality, structure, and characteristics of their

distributed resource environment are presented, followed by a cloud-based knowledge service framework for managing knowledge sources in distributed environments.

"Research and Applications of Cloud Manufacturing in China" sheds some light on the impact of cloud manufacturing on the manufacturing industry as a whole. Zhang et al. consider potential impacts of cloud manufacturing in the context of advanced manufacturing, intelligent manufacturing, sustainable manufacturing, agile manufacturing, and personalized social production modes.

In "Future Manufacturing Industry with Cloud Manufacturing", Li et al. provide a comprehensive overview of cloud manufacturing-related research and development activities in China and provide a snapshot of the state of the art.

"Enabling Product Customisation in Manufacturing Clouds" proposes a concept and architecture to enable the dynamic customization of products based on the availabilities of the production network from the cloud manufacturing concept of Manufacturing-as-a-Service (MaasS). Yip et al. provide an overview of MaaS and a related architecture, which includes core components for product configuration, manufacturing service management, and the integration of factory IT-systems.

In "A Manufacturing Ontology Model to Enable Data Integration Services in Cloud Manufacturing using Axiomatic Design Theory", Valilai and Houshmand propose and discuss a manufacturing ontology model aimed at enabling data integration services in cloud manufacturing environments, based on axiomatic design theory.

"Distributed, Collaborative and Automated Cybersecurity Infrastructures for Cloud-Based Design and Manufacturing Systems" is dedicated to Cybersecurity in the context of CBDM. Thames provides an overview of emerging global-scale cyber information exchange frameworks that will enable cybersecurity in future CBDM environments. In addition, a reference architecture utilizing information obtained from global cyber exchange for dynamic cyber protection of CBDM systems is proposed.

The book concludes with "Teaching Creativity in Design Through Project-Based Learning in a Collaborative Distributed Educational Setting", in which Ito et al. present a case study on teaching creativity in a distributed cloud-based project-based learning environment.

CBDM is a new and exciting paradigm anticipated to significantly impact and reshape product development in distributed collaborative settings. The utilization of CAD and CAE software as a service through the cloud was only the beginning. Cloud-based design used in concert with cloud-based 3D printing services quickly led to the formation of the so-called "makers movement," which is referred to as a New Industrial Revolution. One can anticipate that over the next five years additional types of manufacturing systems and services on a large scale will be provided and utilized through cloud-based environments. Since this exciting field is just at its infancy, a lot is yet to be discovered both in terms of fundamental research and potential application fields.

This book is the first collection of works related to various aspects of CBDM. I hope you find it informative, and perhaps it will spark new ideas and visions that you, the reader, will be sharing with the world in a future publication.

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