

Preface

Owing to globalization, modern manufacturing activities are geographically distributed across the world and away from comprehensive value creation within single enterprises. Original Equipment Manufacturers (OEMs) and partners, among which Small and Mid-sized Enterprises (SMEs) are the main portion, have formed complex and decentralized information chains. Setting up own manufacturing information systems would have meant a massive capital expenditure for enterprises. Moreover, enterprises are usually insufficient in resource and expertise to maintain such complex systems to achieve global and sustainable management. Novel distributed technologies, such as Cloud Computing, are the new-generation supplement, consumption, and delivery models for the over the Internet provision of dynamically scalable resources and utility computing, can support multiple companies to deploy and manage services for accessing and exploiting over the Internet. As thus, a Cloud Manufacturing system or service, which serves multiple companies to deploy and manage manufacturing information and sustainable management services for accessing and exploiting over the Internet, can provide a cost-effective, flexible, and scalable solution to global manufacturing enterprises by sharing complex database and software, with lower support costs on top of that.

This book is aimed at updating the latest research and development in this emerging and important R&D field. A new paradigm called Cloud Manufacturing is introduced, which stands for novel scalable service-oriented sustainable and globally distributed manufacturing systems. In this book, original and innovative chapters have been included to address the major challenges of developing distributed and Cloud Computing technologies for manufacturing systems and services, with scientific and rigorous foundations as well as application values. Covered topics include: innovative design of distributed and Cloud architectures for global and sustainable manufacturing management; distributed process planning and scheduling in global and sustainable manufacturing; modern evolutionary algorithms in Cloud Manufacturing systems and services; sustainable manufacturing practice and Cloud Computing; collaborative product and manufacturing service systems; distributed 3-dimensional data sharing technique for Cloud and Web applications, and relevant

user surveys, applications, and case studies in aerospace and defense industries, remanufacturing, and socialized manufacturing society.

In [Chap. 1](#), the essential features of Cloud Computing are discussed, followed by a Cloud Manufacturing concept. A service-oriented system called Interoperable Cloud-based Manufacturing System (ICMS) is then presented. ICMS provides a Cloud-based environment integrating the existing and future manufacturing resources by packaging them using the Virtual Function Block mechanism and standardized description.

In [Chap. 2](#), a distributed disassembly planning service to support Waste Electrical and Electronic Equipment remanufacturing (WEEE) is reported. In this chapter, a Particle Swarm Optimization-based selective disassembly planning method embedded with customizable decision-making models and a novel generic constraint handling algorithm is developed. Industrial cases on Liquid Crystal Display televisions have been used to verify and demonstrate the effectiveness and robustness of the research in different application scenarios.

As outsourcing demands related to machining task are appearing to be increasingly explosive in recent years, especially in SME manufacturing enterprises, a new production and operation phenomenon characterized by outsourcing machining services has emerged consequently. In order to address the need, [Chap. 3](#) presents a novel Cloud Machining Community mainly focusing on outsourced tasks related to machining processes and parts. A use case fashioning a torque arm of an airplane undercarriage is studied so as to demonstrate the feasibility and applicability of the proposed framework and technologies.

The purpose of [Chap. 4](#) is to confirm which factors actually affect adoption of the Cloud Computing technology in manufacturing companies. The factors are assessed by a randomly selected sample of 47 working professionals in the United Kingdom through an online questionnaire. Analysis of the result shows that Security, Cost, Service Availability, Compliance, and Perceived Usefulness are factors of concern that organizations would have to deeply consider before moving to the Cloud.

Sustainability becomes essential to today's manufacturing systems and a new concern is how to evolve the existing paradigms to meet new challenges using distributed and Cloud Computing technologies. The objectives of [Chap. 5](#) are to examine the manufacturing requirements in a wider scope, to revisit the existing paradigms to clarify the limitations and bottlenecks, and eventually to identify future research directions toward sustainable manufacturing. Within the context, this chapter focuses more on Reconfigurable and Cloud manufacturing system paradigms, and highlights the future endeavors toward better sustainability.

Sustainability has also become a critical driving force shaping the future of Waste Electrical and Electronic Equipment (WEEE) management and remanufacturing. In [Chap. 6](#), lifecycle information and flow management is investigated to enable transition from the current "management authority-centric reporting model for WEEE" to a new "globally distributed and sustainable management model for WEEE". In order to achieve the target, case studies on LCD television WEEE are conducted to understand supply chain information flows and recovery

and remanufacturing processes. Based on that, information/flow framework design for WEEE management is explored.

One of the challenging problems that hinder the development of Cloud-based collaborative systems is the contradiction of large CAD files and the limited speed to share them over the Internet and Web. In [Chap. 7](#), a new 3D streaming technology to transfer design and manufacturing visualization data via the Internet and Web is reported.

[Chapter 8](#) presents a paradigm of designing by services, describes the devising of a service-oriented architecture for collaborative product development systems for this paradigm, discusses the key enabling technologies involved, and introduces the development of a collaborative simulation using service-oriented computing as a case study of software systems implementation.

Recent developments in wireless technologies have created opportunities for developing next-generation manufacturing systems with real-time traceability, visibility, and interoperability in shop-floor planning, execution, and control. [Chapter 9](#) proposes a referenced infrastructure of Ubiquitous Manufacturing (UM), in which a Smart Gateway and a real-time work-in-progress management system based on smart objects such as RFID/Auto-ID devices and Web service technologies are designed to improve the optimal planning and control of the entire shop floor. The presented framework is demonstrated through a near real-life simplified shop floor that consists of typical manufacturing objects.

[Chapter 10](#) presents a review of the R&D literature on distributed collaborative engineering and applications, from the technologies of the 1980s to today's state-of-the-art. Research challenges and opportunities on the research areas are also discussed and highlighted. Distributed and Cloud Computing technologies applicable to distributed collaborative engineering and applications are discussed in detail.

In [Chap. 11](#), the landscape of Cloud Computing is described and a focus is put on the view on the possibility of implementing this new concept in the military world. The strengths and the weakness that the implementation of Cloud Computing can introduce in the military operations are highlighted.

The 11 chapters in this book provide an update and overview of the latest technological development and applications in relevant research areas. This book is believed to make significant contributions to the literature, and can be used as a textbook or reference for mechanical/manufacturing/computer engineering graduate students and researchers for efficient utilization, deployment, and development of distributed and Cloud manufacturing systems, services, and applications.

During the development of this book, we have received invaluable input and gotten great support from the chapter authors. Their commitment, enthusiasm, professionalism, and technical expertise made this book possible. We are also grateful to the publisher for supporting this project, and would like to thank Mr. Anthony Doyle, Senior Editor for Engineering, and Ms. Grace Quinn, Editorial Assistant, for their constructive assistance and earnest cooperation.

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We hope readers find this book informative and useful.

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Weidong Li
Jörn Mehnert

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