

Preface

In this era of knowledge economy, digital manufacturing as a new manufacturing technology and manufacturing mode has become a strong manufacturing power, promoting the development of manufacturing in the 21st century. Its main features are that digital technology has gradually been integrated into the lifecycle of product manufacturing, traditional manufacturing will be transformed and the level of modern manufacturing will be upgraded through information and digital technology, and digitalization will be the indispensable driving factor for the whole product lifecycle in manufacturing. Digital equipment produced by digital manufacturing systems not only has a broad and flexible processing capacity, but also a powerful information processing capability.

Digital manufacturing science is a science, of which the main research object is the digital manufacturing system, the main research contents are basic concepts and pivotal technology, the main research method is the methodology of informatics and system engineering, and the research target is the optimal operation of the digital manufacturing system. It is also a new interdisciplinary research area and the inevitable result of digital manufacturing technology's rapid development.

Based on the never-ending fusion, development, and abroad application of digital technology, network information technology and manufacturing technology, digital manufacture is generated and has become the necessary result of manufacturing enterprises, the manufacturing system and manufacturing process as all continue to realize their digitalization. It makes use of digital quantity, expression, storage, disposal, and control to support global optimal operation in the product lifecycle and enterprise. Its basis is the knowledge fusion of the manufacturing process, and its features are digital modeling, simulation, and optimization. Supported by virtual reality, computer networks, rapid prototyping and databases, it will affect the whole manufacturing process, including product design, function simulation, rapid prototyping manufacture, digitalization of the technology process of products, and rapid production of product that satisfies

users, and it will have high-performance through analyzing, programming, and recomposing information about products, technology and sources according to consumer demand.

Along with the development of digital manufacturing technology, digital manufacture has evolved into generalized digital manufacture involving the product lifecycle and its operation environment from its origin of single production manufacturing and digitalization. Generalized digital manufacture includes digital analysis, design, operation and management of certain links in the manufacturing process such as product demand, product design and simulation, management of production process, operation control of equipment, management of product quality, product sale and maintenance and so on, and the digital operation environment that supports the whole product lifecycle. Moreover, research on digital manufacture also becomes a systematic research including basic theory and technology rather than just a technical one, and digital manufacture becomes digital manufacturing science developed from advanced manufacturing technology.

As a new interdisciplinary subject, the integral subject system of digital manufacturing science should be studied alongside the digital manufacturing system and process, namely on the macroscopic and microscopic aspects. Therefore, this book firstly expatiates on modeling theory and the main modeling method of digital manufacturing science, constructs its basic modeling system and denotes its theoretical supporting system. Secondly, it analyzes and introduces the main basic subject theories that constitute the digital manufacturing scientific theoretical system. These theories involve computing manufacturing science, manufacturing informatics, manufacturing intelligence science, bionic manufacturing science, and technology management science. Lastly, the key technologies of digital manufacturing science are identified and analyzed, and the future development of digital manufacturing science is considered. Digital manufacturing science is a basic element of the modern manufacturing system, and the scientific problem facing modern manufacturing is how to construct its subject system integrally. The contents in this book contribute to the continued enriching and development of digital manufacturing theories and methods.

This book contains nine chapters; we introduce the foundation, concepts, and theory system of digital manufacturing science in chapters one and two; the main subject knowledge in its theoretical supporting system is introduced and analyzed in chapter three to chapter seven; chapter eight analyzes and discusses the key technologies of digital manufacturing science; chapter nine discusses the future development of digital manufacture. Chen Dejun, Zhang Jinhuan, Hu Peng, Ding Guoping, Wei Li, Xu Wenjun, and others compiled the various sections of the book and Chen Dejun is responsible for amending the relevant sections and for coordinating the whole book. Here, I express my heartfelt thanks!

I also appreciate the help and funds from the important international cooperation project “The New Theories and New Technology Research of Network-based Digital Manufacturing Environment” (item number: 50620130441) of the National Natural Science Foundation of China for the publication of this book.

This book about digital manufacturing science is only a preliminary exploration. Due to my limitations, it is inevitable there will be errors in the book, so if experts and readers have any comments or suggestions regarding this book, or detect any errors no matter how trivial, please send them to me; I would be grateful for this!



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