Editorial

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Biographical notes: Xun Xu is an Associate Professor at the Department of Mechanical Engineering, the University of Auckland, New Zealand. He received a BE and ME from Shenyang Jianzhu University and Dalian University of Technology, PR China. In 1996, he received a PhD from the University of Manchester (then UMIST), UK. He heads the Manufacturing Systems Laboratory and is the Director of Intelligent and Interoperable Manufacturing Systems (IIMS) research unit in the University of Auckland. He is a member of ASME and IPENZ. He has published over 100 research monographs and serves as a member of the editorial board for a number of international journals. His main interests lie in the areas of CAD/CAPP/CAM, STEP, and STEP-NC.

Yiming (Kevin) Rong is the Higgins Professor of Mechanical Engineering and the Director of CAM Lab. at WPI. He received his PhD in Mechanical Engineering from University of Kentucky, in 1989. He worked as a faculty member at Southern Illinois University for eight years before joining WPI in 1998. His research areas include manufacturing systems and processes, and computer-aided fixture design. He is the principal investigator of several federal and industrial funded research projects. He is a fellow of ASME and has published two books and over 200 technical papers in journals and conference proceedings.

Lihui Wang received his PhD and MS in Mechanical Engineering from Kobe University, Japan, in 1993 and 1990, respectively, and BS in Machine Design from Academy of Arts and Design (now in Tsinghua University), China in 1982. He was an Assistant Professor of Kobe University and Toyohashi

University of Technology (Japan) prior to joining National Research Council of Canada in 1998. Currently, he is a Professor with Centre for Intelligent Automation at University of Skövde, Sweden. His research interests are focused on distributed process planning, web-based real-time monitoring and control, collaborative design, and intelligent manufacturing systems. He has published four edited books, seven journal special issues and over 150 archival journal papers and refereed conference papers in these areas. He is also a Professional Engineer, and an Adjunct Professor at the University of Western Ontario, Canada.

Today, distributed and collaborative manufacturing has become prevalent due to recent business decentralisation and manufacturing outsourcing. Manufacturers are competing in a global, dynamic marketplace that demands excellence in quality and service, throughput, innovativeness, agility in production, short response time to changing markets, and tight profitable margins. In the 21st century, manufacturing will be gradually pushed towards a distributed environment with increasing dynamism or uncertainty. In order to win a competition, locally or globally, customer satisfaction is treated with priority. This leads to mass customisation and even complex manufacturing processes, from shop floors to every level along supply chains.

Targeting the emerging issues in recent years, manufacturing research has been focusing on improving flexibility, dynamism, agility and productivity for manufacturing in the 21st century, particularly in distributed and collaborative environments. Various Web-based and AI-based tools have been developed to deal with issues in process simulation, production planning, resource scheduling, and supply chain management. Many research projects have been devoted to improving product quality and manufacturing process efficiency targeting manufacturing uncertainty. This special issue titled “Distributed and Collaborative Manufacturing for the 21st Century” brings to the readers some of the state-of-the-art and new achievements in modern manufacturing research. There are eight papers in this special issue and their synopses are provided below.

The paper by de Souza Jr. et al. titled ‘An internet-oriented management and control system in a distributed manufacturing environment’ presents a methodology for effectively managing and control Web-based manufacturing. The methodology is embedded in the WebMachining system, which is based on the Electronic-Manufacturing concept. It integrates engineering and manufacturing information through ERP software. Also presented in this work is a Web-based shop-floor controller for an flexible manufacturing cell made up of a Romi Galaxy 15M turning centre, an ASEA IRB6 robot manipulator, a Mitutoyo LSM-6100 laser micrometer, an AGV, and a pallet to store the blank and finished parts. The implementation architecture is based on the object-oriented technology.

The paper titled ‘Machine model-based remote maintenance and fault analysis system for custom-made CNC machines’ discussed the importance of providing quality maintenance services to highly dispersed customers. This is particularly true for the stone cutting machinery sector because of the high-level customisation of machines and varying working conditions. Remote maintenance based on remote monitoring and analysis combined with realistic simulation is presented in the paper. The authors describe a control-monitoring-simulation architecture built around the use of custom-made machine models working with custom-made control systems.

Li and Gao in their paper, 'Intelligent and cooperative manufacturing planning', introduced three game theory-based strategies, i.e., Pareto strategy, Nash strategy and Stackelberg strategy in order to analyse the cooperative integration of process planning and scheduling in a systematic way. A fuzzy logic-based Analytical Hierarchical Process technique has been applied. Some modern heuristic algorithms have been developed and applied to identify optimal or near-optimal solutions from the vast search space.

The paper titled 'STEP-NC-compliant machine automation to support sawblade stone-cutting machining', presents a STEP-NC technology adaptation to a stone processing case where sawblade machines are used. This work starts with the extension of the STEP-NC data models to covering sawblade stone cutting processes. The modelling process is outlined. The extended STEP-NC model is used in the implementation of a stone-cutting CAM system to communicate with a prototype STEP-NC-compliant stone disc cutting machine.

Zhang et al. reported, in their paper titled 'Implementation of real-time shop floor manufacturing using RFID technologies', an easy-to-deploy and simple-to-use gateway framework with which advanced applications can be developed to achieve real-time, shop-floor manufacturing. Some key enabling technologies including shop-floor gateway, workstation gateway, RFID-enabled smart objects and agent-based workflow management, are integrated into the framework to implement real-time manufacturing data collection, visibility and traceability.

The paper 'Feature and Product Markup Language in service-oriented CAX collaboration' by Khaled et al. proposed an infrastructure to enable the concurrent collaboration of heterogeneous Computer Aided tools for concurrent engineering aspect X (CAX) at the feature level using a service oriented architecture approach. A feature markup language and a product markup language are proposed as the modelling and communication media for feature and product information representation and exchanges that can be independent to the operating system and programming language.

In the paper titled 'Design and simulation of an adaptive and collaborative assembly cell', Keshavarzmanesh et al. described the research work of developing a novel approach for assembly planning and control. The approach is able to handle uncertainty in the assembly shop floor. This approach enables not only adaptive decision-making but also effective plan execution. The work is the continuation of the authors' previous work whereby a framework and a new methodology for adaptive assembly process planning using function block concept was introduced. This paper reports the latest development of design and simulation of a function block communication network in Matlab Simulink environment, and validates the methodology through an example.

Kang and Peng, in their paper titled 'Data integration from product design to assembly planning in a collaborative environment', highlighted a key issue in digital manufacturing, which is integration of design information in different product development stages. The paper presented a method using CAD data in product assembly planning. Product design data are extracted from product CAD models for the need of product assembly analysis and tool accessibility reasoning. A web-based interface is developed for the system implementation and the process simulation.

We wish to take this opportunity to thank all the authors for their scientific contributions to the special issue, and for complying with referees' comments in revising their manuscripts. Through this special issue, we would like to shed some light on the recent research and development on distributed and collaborative manufacturing, and hope to open doors for new research ideas and achievements in the years to come.