
Editorial

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Biographical notes: Pingyu Jiang is a Professor at the State Key Laboratory for Manufacturing Systems Engineering at Xi'an Jiaotong University, China. He received his PhD in Mechanical Engineering from Xi'an Jiaotong University, China in 1991, and was promoted to a Full Professor in 1999. He is the author and co-author of over 100 journal papers, two teaching textbooks, and one monograph. His main research interests include e-manufacturing, virtual manufacturing, etc.

Since 2005, a national basic research programme, entitled "Fundamental Researches on Digital Manufacturing", has been running in China. Seven projects have been set up under the framework of this programme. Huazhong University of Science and Technology is in charge of this large programme. Research teams from six leading universities in China are working together to solve not only technical problems but also scientific problems concerning digital manufacturing. The ultimate objective is to create a set of theoretic methodologies, enabling technologies, key hardware, and software toolkits in order to use digital manufacturing technology in practice.

With the help of this first special issue, we report our current research progress on digital material machining and process quality control. Here, the research outcome related to the process quality control is specifically highlighted, taken mainly from the work done by Xi'an Jiaotong University. In addition, we would also like to take this opportunity to provide a forum for professionals, academics, researchers and engineers around the world interested in studying and using the digital manufacturing, to exchange information with each other.

Originally, the topics of potential contributions include, but are not limited to:

- statistic process quality control with digital measurement
- digital maintenance for machining equipment and process flow
- material machining error modelling with dynamics
- digital manufacturing cells and executive systems
- fault diagnosis for digital equipment
- material machining process simulation with dynamics
- efficiency analysis for manufacturing systems

- digital manufacturing for sculptured surfaces
- sensor network, digital sampling, data processing, etc.
- CNC/STEP NC controllers
- RFID applications in the information tracking of machining process flow
- production planning and scheduling with soft computing
- virtual reality applications in digital machining and assembling
- wireless technology in digital machining and process quality control
- collaboration in digital manufacturing
- mathematical methods in digital material machining and process quality control.

On the basis of the above topic guidance and paper selection/review procedure, 12 technical papers and one research note are accepted to compose this special issue.

The first paper by Zhang et al. titled ‘Application of rough sets theory in knowledge acquisition for cold extrusion process’, presents an intelligent method to use rough sets theory for acquiring and analysing the manufacturing knowledge in the cold extrusion process. The correspondent algorithm deals with data preparation, core attributes calculation, attribute reduction, core values calculation and decision rules induction, etc.

Jiang et al. just give us a description about an e-service driven Statistic Process Control (SPC) model and its programming implementation for the closed-loop quality control in a machining process in the second paper ‘Mobile Statistic Process Control e-service supported with wireless PDA and digital calipers’. Here, digital calipers are used to sample the real-time measuring data and wireless PDAs to run the SPC service module and to realise the on-site quality control management. In addition, both the correlative analysis of signals and the fault trees construction according to potential quality goal parameters play a very important role in searching the certain fault sources to influence the quality goal parameters.

Generally, it is very important to understand the physical changes of casting process in the context of heat transfer and mechanics. So in the third paper ‘Numerical modelling of microstructure evolution and dendrite growth in alloy solidification process’, Xu et al. report a research outcome on using a kind of modified cellular automation method to simulate the evolution of dendrite microstructure accounting for the heterogeneous nucleation, the preferential growth orientation, the solute redistribution both in liquid and solid, the interface curvature and the growth anisotropy during solidification.

The fourth paper ‘An automatic modelling strategy for the reverse engineering of wrap-around freeform surfaces’, written by Sun et al. introduces a kind of a simple modelling method for wrap-around freeform surfaces. A boundary-tracing algorithm is used for extracting four boundaries and correspondent bilinear Coons surface is subsequently established in the planar domain with the given curved boundaries. As a result, the parameterisation of sampled points is gained after thinning data points at the Coons surface. Experimental results are finally given to testify the proposed approach.

Fault diagnosis is one of the most important extended functions to find the possible fault sources during SPC. In the fifth paper ‘An effective approach to rolling bearing diagnosis based on adaptive redundant second-generation wavelet’, by Chen et al.

a new method which combines both Adaptive Redundant Second-Generation Wavelet (ARSGW) and Hilbert transform is put forward. Data-based optimal algorithm is used for implementing the ARSGW so as to lock onto the dominant structure of signals and to reveal the transient components of signals in time domain clearly. While the Hilbert transform is able to derive signal envelope spectrums from wavelet packets. In this way, the envelope spectrums give us a clear interpretation of rolling bearing defects which are from a machine tool in use.

Peng et al. in the sixth paper 'NURBS curve interpolation algorithm adaptive to the machine's kinetic characteristics', just report a NURBS curve interpolation algorithm for high speed NC machining, which can couple with the diverse kinetic characteristics of machine tool and has the function of look-ahead control. In terms of integrating the curve geometric features of workpieces and the dynamic characteristics of the machine tool, the look-ahead control information can be used for controlling the real-time interpolation. This provides a new digital method to control machine tools.

Even in today's manufacturing industries, it is still very important to implement the integration between process planning and scheduling. Focusing on this topic, Tian and Jiang propose an Immune Algorithm (IA) to solve the problem mentioned above in the seventh paper 'An Immune Algorithm for the integration of process planning and scheduling'. In this algorithm, both clonal selection and affinity maturation are used for finding optimal solutions.

In the eighth paper 'Topology optimisation design of multiconstraint continuum structure using sequential quadratic programming method', Yang and Guo give us a presentation about using structural topological optimisation coupled with finite element analysis method for solving engineering problems. In their research, a smooth model of topology optimisation for continuum structures, which has compliance minimisation objective or compliant objective considering stress, volumetric and geometric constraints simultaneously, is proposed.

In fact, digital measurement plays an important role in sampling data oriented from machining status and workpiece geometry. In the ninth paper 'A novel high-speed 3D profilometry for complex surface measuring', Zhou et al. describe a novel 3D measuring method in which Fourier transform profilometry and colour fringe projections are combined to acquire two wrapped phase maps in terms of a single snapshot of object. The key point of this technique is to use it in applications where the object being contoured is going through dynamic changes. It means that dynamic and real time 3D measurement can be reached.

As to handling unorganised measuring data, Liu et al. propose a two-steps method to deal with the estimation problem on unorganised noisy point cloud in the tenth paper 'Estimating curvatures and the Darboux frame from unorganised noisy point cloud'. Here, the first step is to fit a general quadric surface associated with each point with the total least squares algorithm, which permits fast, repeatable, and reliable fitting to the noisy input. The second step is to calculate curvatures and the Darboux frame from the fitted surface.

The 11th paper 'Wavelet-based process quality monitoring and diagnosing', by Liu and Jiang present a methodology for monitoring and diagnosing the process quality by means of integrating wavelet transform, statistical process control technology, and engineering knowledge. The purpose to do as this is to make SPC and fault diagnosis able to work together to sourcing faults that influence the workpiece quality.

Recently, RFID has been widely used in manufacturing process management. Zhang et al. in the 12th paper 'RFID-based smart kanbans for Just-In-Time manufacturing', put forward a framework to use RFID-based smart kanbans for a Just-In-Time (JIT) wireless manufacturing. RFID tags and readers are attached to shop-floor manufacturing objects such as operators, workstations, containers and inventories to make the above object smart and traceable. In this way, we can provide a kind of real-time information visibility needed for realising JIT manufacturing strategy.

The 13th paper 'Facility health maintenance through SVR-driven degradation prediction', written by Cao et al. is a research note that reports their on-going research progress. A facility synthetic failure probability model is established through logistic regression to synthesise each degradation parameter. Furthermore, the prediction of SVR-driven degradation trend and the estimation of usable life for a machine tool are put forward. Based on Monte-Carlo method, an equipment simulator of using Weibull distribution and multi-parameters is established to test the model.

In summary, we can learn that a lot of research progresses on digital material machining and process quality control have been achieved under the framework of this national basic research programme in the first two years. However, we still need to explore new research directions further so as to finish this big project well.

Finally, the Guest Editor would like to thank the Editor-in-Chief of the IJMPT, Dr. M. Dorgham, all the authors who submitted their papers to this special issue, all the peer reviewers who came respectively from USA, UK, Canada, Singapore, Japan, and China, and contributed their valuable comments to improve the quality of the papers selected. Without their support, it would not have been possible to editing this special issue.