Editorial

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Biographical notes: R. Venkata Rao received his BTech from Nagarjuna University, MTech from BHU Varanasi and PhD from BITS Pilani, India. He has 21 years of teaching and research experience and is presently working as a Professor in the Department of Mechanical Engineering of SV National Institute of Technology, Surat, India. He has about 200 research papers to his credit. His research interests include advanced optimisation techniques, CAD/CAM and fuzzy multiple attribute decision-making. He is the editor of three international journals, Associate Editor, Guest Editor, editorial board member, and reviewer for many international journals and conferences.

J. Paulo Davim received his PhD in Mechanical Engineering from University of Porto, in 1997 and the Aggregation from University of Coimbra, in 2005. Currently, he is an Aggregate Professor in Department of Mechanical Engineering of the University of Aveiro and the Head of MACTRIB – Machining and Tribology Research Group. He has more 25 years of teaching and research experience in manufacturing, materials and mechanical engineering with special emphasis in machining and tribology. He is the editor of five international journals, Guest Editor, editorial board member, reviewer and Scientific Advisory for many international journals and conferences. He has also published more than 300 articles in journals and conferences (more than 150 articles in ISI Web Science, h-index 18).

An ever increasing variety of materials is available today, with each having its own characteristics, applications, advantages, and limitations. Many issues, such as better utilisation of raw materials and energy, integration of design and manufacturing activities requiring the invention of suitable new manufacturing processes and techniques, still need to be dealt with. Today's manufacturing processes are caught between the growing need for quality, high process safety, minimal manufacturing costs, and short manufacturing times. Manufacturing process modelling and optimisation not only remains an ongoing activity but has also becoming increasingly important in industry in the drive towards 'agile manufacturing'. In order to meet these demands, manufacturing process setting parameters have to be chosen in the best possible way, according to

demand on quality. For such optimisation, it is necessary to represent the manufacturing processes in a model. Due to the enormous complexity of many manufacturing processes and the high number of influencing parameters, however, conventional approaches to modelling and optimisation are no longer sufficient. Accuracy and possibility of determining global optimum solution depend on the type of modelling technique used to express the objective functions and constraints in terms of the decision variables.

This special issue of *IJMatEI* brings out selected papers of high quality on advanced modelling and optimisation of materials and manufacturing processes. The first paper entitled 'Finite element analysis of ultrasonic insertion of SiC fibre in aluminium alloy 6061' authored by Siddiq and Ghassemieh proposes a computational framework based on finite element method to successfully simulate the fibre embedding using ultrasonic consolidation process. The main components of the proposed computational approach are a developed constitutive material model and a friction model which are especially suitable for the condition of the ultrasonic process. The developed material model takes into account material softening due to high frequency ultrasonic vibration and also frictional dissipation at various interfaces. The effects of different process parameters, such as velocity of sonotrode, displacement amplitude of ultrasonic vibration and applied loads, are studied. The computational predictions are compared with the experimental results.

The second paper entitled 'Multi-objective optimisation of electrical discharge machining process using Derringer's desirability function approach' authored by Baraskar et al. presents mathematical models for relating the surface roughness and material removal rate to electrical discharge machining parameters like pulse-on time, pulse-off time and discharge current. Response surface methodology (RSM) has been applied for developing the models using the techniques of design of experiments and multi-linear regression analysis. A desirability function approach popularised by Derringer and Suich has been used to optimise the EDM process with multiple objectives.

The third paper entitled 'Optimisation of flexing pattern for coated abrasive belt grinding of EN8 steel by Taguchi design' authored by Kennedy and Gowri emphasises the importance of flexing process in providing the defined stiffness to the abrasive belt that play critical role in grinding. Effect on output process parameters by varying the coated abrasives with different flexing types have been investigated. The experiments have been carried out by using the Taguchi's orthogonal array and the results have been analysed using analysis of variance for finding the optimum process parameters.

The fourth paper entitled 'Multi-objective parametric optimisation during electrical discharge machining of inconel 718 with different electrodes' by Beri et al. presents multi-objective parametric optimisation of EDM process by the Taguchi method with grey relation analysis. Experimental investigations are performed on Inconel 718 with three different electrodes. A multi-objective parametric optimisation is converted into optimisation of a single grey relational grade.

The fifth paper entitled 'Machinability study on reinforcement e-glass fibre (multi-filament) composite pipe using carbide tool' authored by Panda and Mahapatra models the multi-responses such as surface roughness and flank wear using desirability criteria. Four factors (such as cutting speed, fibre orientation, depth of cut and feed rate) at three different levels have been designed using Taguchi method to limit the number of experiments. ANOVA is used to check the valid model and the same model has been used in genetic algorithm to find the optimal cutting conditions at minimum label of roughness and flank wear.

The sixth paper entitled 'Multi-objective optimisation of parameters and indirect monitoring of objectives in turning – a cutting tool chatter approach' authored by Tamizharasan analyses the relation between the chatter frequency in machining and the weighted combined objective of the process which is used for implementing the indirect monitoring of flank wear from the experimentally observed chatter frequency. The optimisation techniques such as DoE, adaptive genetic algorithm (AGA), simulated annealing algorithm (SAA) and memetic algorithm (MA) are used in this analysis.

The seventh paper entitled 'Developing parametric window and mathematical model to predict micro hardness of friction stir welded aluminium alloy AA6082' authored by Singh et al. presents the results of investigation on the role of welding parameters such as tool rotational speed, welding speed, axial force and pin diameter in deciding the friction stir weld quality.

The eighth paper entitled 'Multiple-response modelling and optimisation of micro-turning machining parameters using response surface method' authored by Palani et al. investigates the influence of three micro-turning process parameters, cutting speed, feed rate and depth of cut. The response variables are average surface roughness, tool wear ratio and metal removal rate. Statistical models of these output responses are developed using three-level full factorial design of experiment and the developed models are used for multi-response optimisation by desirability function approach.

The ninth paper entitled 'Process capability study of ultrasonic machining for titanium alloys' authored by Singh presents the investigations on the process capability of ultrasonic machining (USM) of titanium and its alloys. Relationships between controllable machining parameters have been deduced.

The tenth paper entitled 'An experimental study on precision grinding of silicon using diamond grinding pins' authored by Alao and Konneh examines the feasibility of quantitative determination of the criteria to realise precision grinding of silicon on an NC milling machine with factorial experimental design.

We would like to thank all the authors who have contributed to this issue and given their perspectives and all the reviewers for their availability and thorough evaluations of these papers. We sincerely hope that the outstanding technical content of these papers will stimulate further research and developments in the near future.