Editorial

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Biographical notes: Mark Jackson is an Associate Professor of Mechanical Engineering at Purdue University, Director of the Advanced Manufacturing Laboratory in the College of Technology and Faculty Associate at the Centre for Advanced Manufacturing and the Birck Nanotechnology Centre. His area of research is advanced manufacturing and has written over 150 scientific papers, edited three books and is on the editorial boards of seven international journals. He is a Fellow of the Cambridge Philosophical Society and was educated at the Cavendish Laboratory, University of Cambridge by Professors John Field and David Tabor.

Prof. J. Paulo Davim is an Auxiliary Professor of Mechanical Engineering at the University of Aveiro. He is Head of the Machining and Tribology Research Group at Aveiro and his research interests includes machining and machinability research and the study of friction and wear of engineering materials.

Since the advent of the high performance grinding process in the 1970s, high performance grinding wheels have transformed grinding from a finishing process to a mass production, high metal removal rate process. A report by Dr. John Webster published in 2006, which is published by the Association of Manufacturing Technology in the USA, concludes that the future of high performance grinding processes depend on competing technologies such as hard turning. However, the development of better grinding wheels and machine tools has led to the development of ultra high-precision grinding processes using fine-grain abrasive wheels and stable machine tool structures.

The report highlights the relative importance of research on fluid applications to prevent burning, stable grinding machine design, analysis and simulation of the grinding process, the relationships between quality, dressing and truing, and the modelling and control of the grinding processes in addition to new wheel designs. There are currently around 350 research projects being conducted in 175 universities worldwide on the development of high performance grinding processes.

This special issue celebrates the achievements of research and developments in the area of high performance next generation grinding wheels. The issue contains eight papers from all over the world and describes current developments in the field of grinding wheels. The first paper by Oliveira Souza and co-workers describes the development of a monitoring system for the conditioning of grinding wheels during dressing. The paper focuses on monitoring power levels during grinding and monitoring acoustic signals during grinding of steel with various grinding wheels. The second paper by Gowri at alia looks at the types of bonding between abrasive grains and bonding systems in coated abrasives. Their paper focuses on the effect of bonding on burr formation and the grindability of steel during belt finishing operations. A subsequent paper by Gowri looks at using a Taguchi analysis when optimising a belt grinding operation using coated abrasives when grinding 304L stainless steel. Again, the bonding system used is one of the most critical factors when optimising the belt grinding process. These papers are followed by a literature review conducted by Liu, Pei and Fisher on wheel wear mechanisms when grinding silicon for semiconductor applications. Their paper acts as a 'springboard' for further research in the field of grinding semiconductor materials, especially grinding wheel designs. The honing of cylinders using the appropriately selected honing stone composition is considered by Kanthababu, Shunmugan and Singaperumal. Their paper focuses on identifying the correct honing stone structure to produce prescribed surface topographical features on the walls of cylinder liners. The grinding of diamond has always tended to create problems for the creators of grinding wheels. Two papers by Jackson, Zhang and Zhang focus on the effectiveness of using Lithia-rich ceramic bonding systems for diamond wheels to grinding polycrystalline compacted diamond. The papers address the performance of these structures compared with resin-bonded diamond wheels grinding compacted diamond cylinders. Finally, Zhang, Jackson and Ni provide an analysis of using the spindle speed variation method for suppressing machining and grinding chatter. Their work highlights the importance of varying spindle speed during the grinding of automotive components and explains how the avoidance of chatter can be achieved by modelling the process using non-linear delay differential equations. A model is presented for chatter during machining based on internal energy analysis of cutting and the instantaneous sideband effect, which is meaningful for the practical application of spindle speed variation machining and grinding.

We hope that this special issue will serve as a reference volume consisting of high quality research papers especially for research workers and grinding applications engineers. The papers presented in this volume have been refereed by peer reviewers whom are experts in the field of grinding wheel technology. The referees have been extremely helpful and have returned reviews as per schedule. We wish to thank them for their reviews and the authors for submitting such high quality research papers.