Editorial

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Biographical notes: Mark J. Jackson is an Associate Professor of Mechanical Engineering in the College of Technology at Purdue University and is a faculty associate in the Center for Advanced Manufacturing and the Birck Nanotechnology Center. His areas of research are manufacturing processes including high performance grinding and machining.

Since the advent of the creep feed grinding process in the 1960s, high performance grinding processes have transformed grinding from a finishing process to a mass production, high metal removal rate process. There are currently around 350 research projects being conducted in 175 universities worldwide on the development of high performance grinding processes. A recent report by Dr. John Webster, 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 by Webster highlights the relative importance of research on fluid application 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 process.

This Special Issue celebrates the achievements of research and developments in the area of high performance grinding processes. The issue contains 19 papers from all over the world and describes current developments in the field of high performance grinding. The development and design of high speed grinding wheels is of paramount importance and it is important to design grinding wheels that are designed in accordance with accepted design codes and international standards. Jackson describes the principles of designing high speed grinding wheels for safe operation. The problems associated with coolant and oil mist reduction and a new type of fluid delivery system are explained in detail by Tso and Huang and by Irani, Bauer and Warkentin. A new form of dressing using a directed laser beam is discussed by Wang et al. that demonstrates the use of an energy balance model to predict the effect of various laser-processing parameters on the effectiveness of a resin-bonded alumina grinding wheel. Jackson, Robinson and Chen also employed the use of lasers to clean and dress vitrified grinding wheels. Again, the effect of various process parameters are shown to improve the operation of the grinding wheel during high speed grinding operations. Mechanical and thermal behaviour and

their effects on the grinding process is investigated using acoustic emission techniques and are described by Chen, Griffin and Liu and by Pearce, Fricker and Speight. An interesting development introduced by Brinksmeier and Bleil shows how the mechanical energy derived from the 'size effect' is used to harden the workpiece material during the grinding process. The thermal energy generated in grinding is reported by Salonitis and Chryssolouris as a way of hardening the workpiece material. This technique utilises the thermal energy created during grinding as a way of controlling phase transformations during the grinding process.

Predictive modelling is a growing field of study that is described by Park, Liang and Chen using micro grinding forces and by Alauddin, Zhang and Hashmi using a dimensional analysis approach with a response surface methodology. The interaction of process and machine tool during grinding is investigated by Aurich et al. and is directed towards the development of a comprehensive simulation concept. The monitoring of the dressing process is discussed in detail by Oliveira, Carvalho and Braga using artificial intelligence techniques. The development of grinding for processing advanced materials such as γ-TiAl, hardened steel and monocrystalline silicon is explained by various authors who show the importance of grinding and its effects on material properties. Economical aspects of grinding and the design of grinding experiments are described by Uhlmann and Pei, respectively.

I 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. This papers presented in this volume have been refereed by peer reviewers who are experts in the field of grinding technology. The referees have been extremely helpful and have returned reviews as per schedule. I wish to thank them for their reviews and the authors for submitting such high quality research papers.