Editorial

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Biographical notes: Taghi Tawakoli is Founder and Director of the Institute of Grinding and Precision Technology, KSF, in the Hochschule Furtwangen University in Villingen-Schwenningen, Germany. Currently, he leads projects involving new technologies in grinding and finishing in KSF in collaboration with the industry.

One of the most important factors for the competitiveness of products in global production is the quality and functionality of the product. The quality and functionality are mainly guaranteed through manufacturing processes. Foremost, the final manufacturing processes are decisive for these important aspects.

Until 15 years ago, grinding was the final manufacturing process. Nowadays, in some cases, a level of quality is required, which cannot be obtained by grinding. Therefore, other processes such as, super finishing, lapping, honing, flow machining, magnets assisted machining, Magneto Rheological Finishing (MRF), micro-cutting, etc., are introduced into the industry. Most of these successive processes are based on machining with abrasive grains and show similarities to grinding. In other words, grinding is still the most important manufacturing process for precision and ultra-precision machining.

In this special edition of *International Journal of Mechatronics and Manufacturing Systems*, the most important processes of the production technology and the newest developments in grinding and adjacent processes are presented.

Ultrasonic-assisted grinding and ultrasonic-assisted dressing are the newest development trends in fine finishing and grinding technology. T. Tawakoli, B. Azarhoushang and M. Rabiey show that ultrasonic-assisted grinding results in finer surfaces with significantly lower grinding forces and grinding temperatures.

In the paper of T. Tawakoli, A. Rasifard and B. Azarhoushang ultrasonic-assisted dressing for CBN and conventional grinding tools is introduced. In ultrasonic-assisted dressing, abrasive grains are being fragmented and cracked because of the new kinematic of the process. The fragmented grains can easily remove the material and, at the same time, grinding forces and thermal effects on the surface of the workpiece are reduced.

J.A. Webster and P. Grün discusses the cooling effect of grinding fluids, the thermal energy partitioning that occurs with different modes of grinding, and guides the reader towards processes with lower specific energy and more desirable energy partitioning with respect to the energy that enters the final workpiece surface.

E. Uhlmann and V. Mihotovic have investigated new kinematical concepts aiming at an increased productivity and product quality and the availability of advanced machine systems and components, which allow a new speed range in terms of cutting speed and feed rate that is applied to overcome today's process limits.

The developments in the grinding-tools and in the processes which are applied after the grinding process as a final process, and also the monitoring of the manufacturing process, are presented by T. Tawakoli. The monitoring is especially important for the grinding process and is also essential for recognising changes in the process, which are the cause of higher power, temperature, vibrations, etc. The possibilities for the monitoring of the process and the analysis of the results are described in the paper.

A stochastic model of the broaching tool is proposed by G.E. Vargas, K. Wegener and F. Kuster to reach a deeper understanding of the hard broaching process, and, also, for its optimisation. The model-based analysis shows several suggestions for the improvement and optimisation of the process, which have been experimentally verified in the work.

H-W. Hoffmeister and M. Pekárek describe the basic types of dressing tools and their corresponding parameters for superabrasive diamond- and CBN-grinding-wheels. Recent sharpening procedures for those kinds of grinding wheels are also presented in the study. These are, for instance, sharpening with electro-discharge machining and electrolytic sharpening, ELID or laser sharpening.

A concept, which is based on optimisation of the chip formation which causes a considerable reduction of friction and rubbing in the process, is presented by T. Tawakoli and M. Rabiey. The innovative method presented in the study is based on the specific structuring of the vitrified wheels using the dressing tools. The results show a significant reduction of grinding forces in the new method compared to the conventional one at the same material removal rate.

The subjects of the Special Issues have been selected keeping in mind the importance of the fields in question and in the firm belief that modern grinding and precision technology will merge to develop manufacturing processes of the future.