Handbook of Machining with Grinding Wheels

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Preface

Grinding, once considered primarily a finishing operation involving low rates of removal, has evolved as a major competitor to cutting, as the term "abrasive machining" suggests. This is what Milton Shaw, the man who is considered the great pioneer and father of American grinding, said about 10 years ago. Shaw led the development of grinding in the United States over the last 50 years.

We named this book *Handbook of Machining with Grinding Wheels* because the borders between grinding and other operations such as superfinishing, lapping, polishing, and flat honing are no longer distinct. Machining with grinding wheels extends from high-removal rate processes into the domains of ultra-high accuracy and superfinishing. This book aims to explore some of the new "transition operations," and for this reason we chose this title.

This book presents a wide range of abrasive machining technology in fundamental and application terms. The emphasis is on why things happen as they do, rather than a how-to-do-it approach. The topics covered in this book cover a range of abrasive machining processes with grinding wheels, making this probably the most complete book regarding all kinds of grinding operations.

The aim of this book is to present a unified approach to machining with grinding wheels that will be useful in solving new grinding problems of the future. It should be of value to engineers and technicians involved in solving problems in industry and to those doing research on machining with grinding wheels in universities and research organizations.

The team of authors are famous researchers who have devoted their entire lives doing research in this field and who are still actively contributing to new research and development. The authors represent a large region of the world where abrasive machining with grinding wheels are most advanced: United States, Great Britain, Japan, and Germany. I thank my co-authors for taking time from their busy activities to write and review this book over a period of 2 years.

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The main purpose of this book is to present abrasive-machining processes as a science more than an art. Research and development on abrasive-machining processes have greatly increased the level of science compared to 25 years ago when many aspects of abrasive machining processes still depended largely on the expertise of individual technicians, engineers, and scientists.

The book has two parts: "The Basic Process of Grinding" and "Application of Grinding Processes." This structure allows us to present more about *understanding of grinding behavior* in the first part and more about *industrial application* in the second part,

loan D. Marinescu *Toledo, 2006*

The Authors

Ioan D. Marinescu is a professor of mechanical, industrial, and manufacturing engineering at the University of Toledo. He is also the director of the Precision Micro-Machining Center of the College of Engineering (www.eng.utoledo.edu/pmmc) of the same university. He has a Ph.D. in manufacturing processes, an honorary doctorate from University of Iashi, Romania, and is a member of numerous international professional organizations: **JSPE, SME, ASME, ASPE, CIRP, IDA,** ASAT, and NAMRI.

Professor Marinescu is author of more than 15 books and over 300 technical and scientific papers. He has given lectures and workshops in more than 40 countries around the world. Also, he is the executive director and cofounder of the American Society for Abrasive Technology.

Ten years ago, Dr. Marinescu founded his own company, Advanced Manufacturing Solutions Co., LLC, a company that specializes in consulting, R&D, manufacturing, and trade (www.interams.com). He is the president and CEO of this company.

Mike Hitchiner obtained his doctorate in 1982 at the University of Oxford for research in grinding and machining with cubic boron nitride (CBN) and diamonds. After a another 3 years of university research in diamonds and CBN, he joined Saint-Gobain Abrasives (SGA) and its affiliate companies in 1985. He worked initially on conventional abrasive grain manufacture and advanced ceramics before becoming R&D manager for vitrified CBN in Europe in 1987. In 1989, he joined Universal Superabrasives (SGA) as technology manager for vitrified CBN for the U.S. market. More recently, he has broadened his responsibilities as the technology manager for precision grinding applications for North America, as well as projects throughout Asia and Europe.

Eckart Uhlmann is the director of the Fraunhofer-Institute for Production Systems and Design Technology IPK and professor of machine tools and manufacturing technology at the Institute for Machine Tools and Factory Management of the Technical University in Berlin, Germany. He received his doctorate in engineering on "Creep Feed Grinding of High-Strength Ceramic Materials." Prior to his academic career, he served several years as vice-president and director of research and development at Hermes Schleiftnittel GmbH & Co., Hamburg, Germany. In addition to being a consultant for various German and international companies, Dr. Uhlmann holds many professional memberships, including the Berlin Wissenschaftskommission, the Verein Deutscher Ingenieure, and the International Institution for Production Engineering Research. He also holds an honorary doctorate from Kolej Universiti Teknikal Kebangsaan, Malaysia.

W. Brian Rowe gained 6 years of experience with Austin Motor Company, Birmingham, England, and another 6 years with Wickman Machine Tools, Coventry, England. He studied at the University of Aston in Birmingham earning an honors degree in mechanical and production engineering in 1961. He earned a Ph.D. for research on the mechanics of centerless grinding at Manchester University in 1964 and became a doctor of science in 1976 for his wider research on tribology. He became the head of mechanical engineering in 1973 at Liverpool Polytechnic (later to become Liverpool John Moores University) and eventually became assistant rector responsible for corporate academic development, strategic planning, and for development of research. In 1992, he relinquished his administrative responsibilities in order to focus on research. As director of the Advanced Manufacturing Technology Research Laboratory (AMTREL), he built up a significant team of researchers that worked closely with industry in the United Kingdom. AMTREL has made

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