
Book Review: Machining Fundamentals and Recent Advances by J. Paulo Davim, Ed.

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Biographical notes: Viktor P. Astakhov received his PhD in Mechanical Engineering from Tula Polytechnic University, Tula-Moscow, Russia in 1983. He was awarded a DrSci (Doctor habil.) designation in 1991 for his outstanding performance and profound impact on science and technology. Currently, he is a Professor at Michigan State University and Tool Research and Application Manager at General Motors Business Unit of Production Service Management Inc. His main research interests include theory of metal cutting and its applications; cutting tool design, assessment and optimisation; and machinability of materials, new tool materials and coatings. He has also won awards for both his teaching and research. He has published books, book chapters and many papers in professional journals as well as papers in trade periodicals. He is an editor, Board Member, Reviewer and an Advisor for many international journals.

A large portion of industrial products are fabricated using machining as the most common method of converting various materials into the required shape and size. The purpose of machining is to finish the surface more closely to specified dimensions than can be done by other shaping methods. Although machining the basic of machining has its roots going to the beginning of human civilization, the machining technology continues to have enormous economical range remaining to be indispensable for modern industry in both unique and mass high-quality part productions.

With the development in 1959 computer numerical control (CNC) and later direct numerical control (DNC) machines, machining centers, manufacturing cells and production lines became more intelligent that allowed increase machining productivity, accuracy and efficiency. With these rapid developments, experts began to think that completely automated manufacturing factories managed by computers with the help of robots and automatic guided vehicles (AGVs) with no operators and other manufacturing personnel besides maintenance crew. Although a number of attempts have been made to

build such fully automated units, it not yet happened in reality of production because of a definite lack of knowledge on metal cutting process that constitutes the very core of any machining operation. It should be clearly realised by manufacturing community that quality, productivity, efficiency, reliability and sustainability of machining operations are defined on the tool cutting edge where the metal cutting process take place.

The reviewed book is a significant step ahead in understanding of machining. Due to the vast professional experience and vision of the editor, it combines coherently the fundamental aspects and recent advances in the field. In the reviewer's opinion, anyone involved in machining will benefit from reading this book.

Chapter 1 of the book provides the basics of metal cutting mechanics and modelling using the finite element method. It pointed out the major problems and discusses the possible way of their solutions. Chapter 2 discusses the essentials of the cutting tool geometry and cutting tool wear including the standard and advanced methods of its assessment. Chapter 3 presents a unique vision of machined surface integrity. The mechanisms, modelling and experimental evaluations of the material and mechanical aspects of surface integrity are discussed. Chapter 4 deals with machining of hard materials. It covers the basic features, specifics of machine tools and tooling, particularities of the cutting process and surface integrity in hard machining process. Application aspects as hard turning, milling reaming, etc. are of particular interest for many machining engineers and practitioners. Chapter 5 deals with machining of particulate-reinforced metal matrix composites. It discusses particularities of chip formation, surface integrity, cutting forces, tool wear and tool life. Chapter 6 provides the basics of drilling of polymeric matrix composites. It walks the reader from the definition of the work material towards the modelling of the process and assessment of damage generated during drilling. The damage suppression methods are discussed. Chapter 7 deals with the ecological aspect of various coolants used in machining. Near-dry (MQL) machining is in the focus of attention of this chapter. It provides explanation to the efficiency of near-dry machining and points out the importance of the system consideration of this process. Chapter 8 relates to the machining of complex surfaces, ruled or sculptured found in forge and stamping dies, injection moulds or turbine components. Three-, four- and five-axis cases are considered with some practical examples. Chapter 9 discusses aspects of high-speed grinding and new grinding wheels. A basic examination of process mechanisms that relates the configuration of the grinding tools and requirements for grinding soft materials is discussed. Chapter 10 provides timely review of the current development and recent advances in micro and nanomachining. It discusses the machining effects as mechanics and chip formation at microscale. It compares nanometric machining and conventional machining. Chapter 11 presents an array of non-traditional machining process as ultrasonic machining, water-jet cutting, electric discharge machining, laser beam machining, electrochemical machining, abrasive flow machining magnetic abrasive finishing, and magnetic float polishing. It also discusses some aspects of micromachining. Chapter 12 is an introduction to intelligent machining. It discusses means and tool for such machining that includes its modelling using neural networks, fuzzy set theory, finite element method and optimisation.

This book can be used for final undergraduate engineering courses (for example, manufacturing, mechanical, materials, etc.) or as a subject on machining and manufacturing at the postgraduate level. Also, this book can serve as a useful reference for academics; manufacturing and metal cutting researchers; mechanical, manufacturing and materials engineers; and professional in related industries with metal cutting.