
Book Review

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Drills – Science and Technology of Advanced Operations

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Drilling is one of the most time-consuming metal cutting operations in the typical shop. It is estimated that an important part of all machine hours is spent performing drilling operations. Therefore, the use of high-performance drilling tools can significantly reduce the time required for drilling operations, and thus reduce drilling costs.

Developments of modern machines, tool holders, coolant units, automated part fixture and so on made many drilling operations the weakest link in terms of further increase machining efficiency. This is due to a lack of understanding of not only the process and its challenges, but primarily of the design, manufacturing, and application methods of high-productivity (HP) drilling tools. It is totally forgotten that process efficiency is primarily decided on the cutting edges of the drill as this tool does the actual machining.

The reviewed book is a significant step ahead in the development of HP drills as it combines coherently the fundamental aspects and recent advances in the field including the drill design and manufacturing particularities, tool materials, drill failure analysis, and drilling operations metrology. It aims to address the most important issues in drilling operations, and thus to provide assistance with the design of such operations. It discards many old notions and beliefs and introduces scientifically and technically sound notions with detailed explanations. In the reviewer's opinion, anyone involved in machining will benefit from reading this book as its coverage extends much beyond drilling tools.

Chapter 1 consists of two logically connected parts. The first introductory part presents a short classification of drilling operations, components of drilling regime, and established proper terminology. The second part defines the concept and structure of the drilling system introducing the coherency law for such a system. Chapter 2 considers drilling tool failure analysis as a system issue. The causes of drill failure and their proper identification are discussed. Chapter 3 is devoted to cutting tool materials. This chapter differs considerably from other chapters/ books written on the subject in that it provides the knowledge base and practical information on tool materials for drilling tool designers, manufacturers, and end users. In Chapter 4, the drilling tool geometry is considered in the tool-in-hand system (T-hand-S), in the tool-in-machine system (T-mach-S), and in the tool-in-use system (T-use-S). The relevance of these systems to drill geometry parameters indicated in the tool drawing and to tool performance is revealed. Chapter 5 includes two

parts. The first one discusses the designs and technologies of PCD drilling tools developed to meet the challenges of both new work material and high-speed machining, primarily in the automotive and aerospace industries. The second part considers classification, geometry, and design of deep-hole drills. It deals with force balance and defines the term self-piloting tool (SPT). Chapter 6 argues that there are three equally important pillars for the successful application of the metal working fluid (MWF) in machining:

- 1 selection of the proper MWF
- 2 delivery of this MWF into point of application
- 3 MWF maintenance.

The chapter considers each of these aspects in great details. Chapter 7 consists of two closely related parts. The first part is related to the various tolerances on the hole being drilled. The second part deals with drill metrology. Appendixes provide support to the listed chapters. Appendix A discussed the axial force, torque, and power in drilling operations. Appendix B provides the supporting material for better comprehension of Chapter 3. Appendix C aims to familiarise readers with the basic notions and definitions used in the analysis of tool geometry and the correlation of tool geometry parameters with the cutting force.

This book can be used for undergraduate engineering courses (for example, manufacturing, mechanical, materials, etc.) or as a subject on machining and manufacturing at the postgraduate level. It can be used as a course manual for career and vocational training courses and career training classes. This book can serve as a useful reference for academics; manufacturing and metal cutting researchers; mechanical, manufacturing and materials engineers; and professional in manufacturing and applications of advanced metal cutting tools primarily in the automotive and aerospace industries.