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## **Book Review**

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**Surface Integrity in Machining**

**by: J. Paulo Davim (Ed.)**

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**236 Gray's Inn Road, Floor 6, London WC1X 8HB, UK, 215p**

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All the varied modern technologies depend for the satisfactory functioning of their processes on special properties of some solids. Mainly, these properties are the bulk properties, but for an important group of phenomena these properties are the surface properties. This is especially true in wear-resistant components, as their surface must perform many engineering functions in a variety of complex environments. The behaviour of material therefore, greatly depends on the surface of the material, surface contact area and environment under which the material operates.

Surface engineering, as a branch of applied science, was introduced approximately 15 years ago to provide the most important means of engineering product differentiation in terms of quality, performance and life cycle cost. To deal with real surfaces in manufacturing, the concept of surface integrity (hereafter, SI) evolved by means of defining the inherent or enhanced condition of a surface produced in machining or other surface generation operation.

Since its introduction, the notion of SI has attracted the attention of many researches and practitioners in manufacturing. However, not much progress was achieved in practical implementations of its basic concepts since then. Being recognised as important in improving the quality of machined parts, the concept of SI remains at its infant stage. In other words, everybody seems to like it, but not much has been done to advance the concept to the next stage of maturity.

The reviewed book is a significant step ahead because its objectives are to provide all the means for clear understanding of the current state of the art, and to lay down a solid foundation for the further developments. This unique combination became possible as the editor using his broad experience and high professionalism, managed to assemble a coherent team of authors of various backgrounds that capable to achieve these ambitions objectives. In the reviewer's opinion, anyone involved in machining process design/development/research, quality control, and machines/structures reliability analysis/improvement will benefit greatly from reading this book.

Chapter 1 presents an overview of the nature of the surface that results from manufacturing processes, as this nature has long been recognised as having a significant impact on the product performance, longevity and reliability. It points out that surface alterations may include mechanical, metallurgical, chemical and other changes. These

changes, although confined to a small surface layer, may limit the component quality or may, in some cases, render the surface unacceptable. SI reveals the influence of surface properties and condition upon which materials are likely to perform. Chapter 2 provides an overview of current knowledge on surface texture produced by machining along with recent advances in surface characterisation and evaluation. Various texture parameters are described and their significance in SI is considered. Theoretical models for roughness parameters and experimental trends correlated to machining conditions are discussed. Isotropy of machined surfaces is also considered and methods for surface typology are finally discussed. Chapter 3 presents an overview of residual stresses and microstructural modifications in surface layers in machining. Mechanical, metallurgical, chemical and other surface alterations due to machining are considered. The applications of some of these concepts in machining are discussed in this chapter. Modelling of thermally induced damage in grinding concludes this chapter. Chapter 4 deals with characterisation methods for SI. This chapter reports a basic technologies used to characterise different aspects of SI. Surface roughness measurement techniques, X-ray diffraction and electron diffraction for analysing the crystalline structure an X-ray energy-dispersive analyser, Auger electron spectroscopy, and X-ray fluorescence included for elemental analysis, X-ray photoelectron spectroscopy and secondary ion mass spectrometry for chemical composition analysis are considered. The chapter concludes with presenting the microcrystalline structure and dislocation density technology and transmission electron microscopy. Chapter 5 analyses SI of machined surfaces. An overview of SI characteristics includes surface roughness/surface topography, specific metallurgical and microstructure alterations and process-induced residual stresses. Surface roughness is assessed by many important 3D roughness parameters and representative scanned surface topographies. Possible surface alterations resulting from abusive machining are revealed. Finally, state-of-the-art finishing cutting, abrasive and non-traditional operations are considered to show how the manufacturing processes can be effectively utilised and optimised in practice. Chapter 6 considers important emerging issues in SI of micro- and nanomachined surfaces. It provides a state-of-the-art review of micro- and nanomachining and the measurement of SI of micro- and nanomachined surfaces. The chapter shows how X-ray diffraction and microscopic techniques are used to measure surface characteristics of micro- and nanomachined surfaces.

This book can be used for final undergraduate engineering courses (e.g., 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, professional in related industries with metal cutting.