

# Handbook of Machine Tool Analysis

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# Preface

The past two decades have been characterized by the dynamic development of many technical and scientific domains, and the development of machine tools has been on this same trajectory. The complexity of machine tools has increased, as well as their intersection with other fields, primarily electronics. The new generation of machine tools is very different from the previous generation, from which a large amount of experience has been gained. The modern systems of machine tools have new rules of design, research, and fabrication.

This book presents the new research in this large domain of machine tools and tools. The book's main contribution is the establishment of technical diagnosis by the aid of the evolution of machine parameters, which can be correlated with the functionality of the machine tool as well as that with the tool.

Two factors have contributed to these developments: one is the increase in the complexity of machine tools and their integration in flexible manufacturing systems, and the second is the success of the monitoring and diagnosis of other fields. By correlation of these aspects with the development of computer hardware, the book details the replacement of conventional systems with virtual instrumentation. This represents the step from an "art" in the field of machine tools to the science of the diagnosis of these systems. The specialized software systems create

the possibility of scientific diagnosis and monitoring of the technological systems.

Together with the traditional instruments used in the monitoring and diagnosis of machine tools (investigating such aspects as forces, vibrations, and acoustic emission), the expert system is presented together with neural processing of the information.

The [first chapter](#) reviews general notions about technical diagnostics of machine tools. The [second chapter](#) is dedicated to the state of the art of research concerning vibroacoustic diagnosis of machine tools. [Chapter 3](#) presents an original systematization and application of a package of vibroacoustic methods to establish the technical diagnostics of machine tools. [Chapter 4](#) describes the experimental research in diagnostic analysis of the mechanical system of the feed kinematics chain. Virtual instrument packages for diagnosis by vibroacoustic methods are described in [Chapter 5](#). Specific elements from the feed kinematics chain are diagnosed by virtual instrument packages in [Chapter 6](#). [Chapter 7](#) deals with a neural approach to the problem of establishing technical diagnosis for machine tools. In [Chapter 8](#), we conclude by presenting the original research on which this book is based. In order to prove that the method works, a few case studies are presented in the three appendixes.

This book is a joint effort with my former professor, Constantin Ispas, a well-known specialist in machine tools in Romania, and one of his graduate students, now Dr. Dan Boboc. The topic of the book was the main theme of Dr. Boboc's dissertation a few years ago.

The authors would like to express their gratitude to two of their graduate students, Dr. Radu Pavel and Liviu Luca of the Precision Micro-Machining Center at The University of Toledo, Ohio, for assisting with the manuscript. I give special thanks to my wife, Jocelyn, for her patience in polishing the English of this book, which was written by native Romanian authors. I also thank Rita Lazazzaro and Barbara Mathieu of Marcel Dekker, Inc., for their help and for keeping us on track.

Ioan D. Marinescu

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