

VIBRATION DIAGNOSTICS IN MANUFACTURING SYSTEM
WITH WATER JET TECHNOLOGY

by

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Preface

The scientific monograph represents results of a long-year cooperation between the Department of Manufacturing Processes Operation (DMPO), Faculty of Manufacturing Technologies with a seat in Prešov, Technical University of Košice and the Fluid Ray Department of VŠB - Technical University of Ostrava. The cooperation resulted in numerous scientific outputs in the form of projects, articles, monographs and theses. Presented monograph prepared with support of the projects KEGA 027TUKE-4/2014 and of VEGA 1/0381/15 is aimed to enhance this series.

The monograph summarizes the knowledge and experience acquired during research work closely connected with several doctoral studies performed at DMPO and materials collected during further education activities in the field of monitoring and diagnostics of manufacturing systems operation.

The aims of the scientific monograph are formulated in two directions. Significant is to mediate basic knowledge on measurement and assessment of vibrations as well as on technology of waterjet. Therefore, the scientific monograph offers a review of topics being important for creating of basic idea about measurement and assessment of vibrations in practice, about basic principle of waterjet technology functioning and about influence of the selected technological factors upon size of vibrations in machining by waterjet technology.

The monograph is intended for academic workers, students of higher study levels and professionals with interest of getting deeper knowledge in the field.

Authors

Introduction

At present, the machining ranks among the inseparable processes of material treatment. Our concern is to achieve the utmost productivity in manufacturing assured by high precision and quality surface. This is the main reason for the machining having been subjected to a long-term development to reach current version. However, a few undesirable factors inevitable to be defined at first influenced the development. One of such factors is represented by vibration or oscillation of machining tools occurring during machining of material and is frequently referred to as the most serious problem in further improvement of machining process.

Vibration diagnostics deals with the analysis of vibration. This branch utilizes diverse sensors and specialized software to acquire inevitable information on machining tool condition. The basic aim of vibration monitoring is to acquire information on operation and technical condition for the purpose of assurance of planning and control of maintenance. The main reasons for vibration measurement in practice can be, for instance, verification of dynamic loading of the tool or of its parts, prevention of resonance inducing in important parts of the tool, possibility of localization and damping or isolating of vibration sources. The vibration measurements are also performed to provide diagnosis without dismantling, monitoring of operation conditions of the tool or to assure the possibility of computer modelling and verification.

The monograph is divided into ten parts. The first part deals with the issue of unconventional technologies. The second part entitled Description and Characteristics of Waterjet Technology includes the topics such as principle and methods of waterjet machining or types of the applied jets. The final section of the second part of the monograph is devoted to the technological unit of a workstation for abrasive waterjet cutting. The Parameters Influencing the Machining is the title of the third part describing the basic physical, hydrodynamic, and technological factors affecting abrasive waterjet process. The detailed description involves the issue of specification of the parameters influencing the waterjet technology. The fourth part of the monograph entitled Methodology of Measurement and

Assessment of Experiments contains basic information on performance of the individual experiments such as, for instance, measurement conditions, procedures related to experiment preparation or procedures of processing and assessment of the measured values. The detailed assessment of the individual sets of experiments is presented in the fifth part of the monograph. The sixth and the seventh parts of the monograph pay attention to creation of a mathematical model and consequently to transformation of a model into the simulation program. The monograph presents actual theoretical knowledge and the results of relevant research.