Mechanics of Wood Machining

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Second Edition

Springer

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Foreword

Wood is one of the most precious materials of the mankind. Since ancient times wood material has been widely used and most of the utensils, shelters and dwellings was made of wood. Wood may have exceptional beauty in all shades of colour and many species have excellent durability withstanding many hundreds of years. The oldest wooden buildings have withstood storms and disasters over 1,300 years. At the same time, wood materials require one of the lowest energy inputs on the earth.

Since ancient times the wood has been shaped by mechanical woodworking operations as we do today. We stand with astonishment and true admiration before a 20 m high wooden column, somewhere in China or Japan, worked by hand with incredible accuracy—a thousand years ago!

Today we have modern woodworking machines and hand tools; however, the quality of the raw material is continuously declining. We are forced to use this precious material with care and more economically, reducing waste as much as possible. To fulfil this requirement, efforts are being made worldwide to develop new machines, tools and technologies, for instance thin-kerf saws, wear resistant tools, quality assessment, and using of smaller size raw materials, etc.

The first comprehensive textbook on "Theory of Wood Processing" in Hungarian was published in 1994 and used by students at the Faculty of Wood Science, at the University of Sopron. This textbook contains a special chapter on the "Theory of Wood Cutting" and its related topics. Since the preparation of this book, almost 20 years have passed, and during this time new theoretical and practical knowledge accumulated and some new methods have been developed.

This book is the improved and expanded version of the above mentioned chapter, supplemented with several related topics on vibration and stability of woodworking tools, the phenomenon of washboarding, tensioning methods and pneumatic clamping. The last chapter contains an important topic on wood surface roughness. In the last 15 years, fundamental research work has been done in this field and new approaches were developed. The new methods developed made it possible to characterize the different wood species with numerical values and to find general relationships concerning very different wood species.

It should be stressed that important results and new ideas have been published and, with all probability, will be published in many languages all over the world. Therefore, it is of great importance to consider all significant works done whenever and everywhere.

I hope this new textbook on the "Mechanics of Wood Machining" will contribute to the better understanding of physical phenomena associated with real woodworking processes. The material presented is designed for graduate and postgraduate students, researchers and also to help practising engineers find the pertinent knowledge on this subject.

Sopron, Hungary, November 2011 György Sitkei

Preface

The importance of economical processing and manufacturing of various wood products is everincreasing. During technological processes wood materials may be exposed to various mechanical effects, e.g. the interactions between wood materials and different kind of tools, and the general laws governing these interactions should be known.

The behaviour of wood materials deviates essentially from that of the generally known elastic materials. Wood has a strong anisotropy and viscoelastic properties which have highly aggravated the derivation of generally valid relationships. In the past time, because of our lack of understanding, knowledge of these processes was essentially restricted to empirical relationships and practical recommendations.

This textbook has attempted to develop a mechanics of wood machining in depth and extent so that it defines and delineates an area of knowledge that may be a new discipline in the future. Each topics in this book is developed from fundamental concepts of mechanics. Where possible, mathematical treatment has been developed in quantitative terms to express specific wood-machine relations on the assumption that these relations should obey fundamental laws. Such a mechanics is capable of describing and predicting the interaction of wood and machine in terms of performance, quality and energy consumption. In many cases working diagrams are elaborated to facilitate the consideration of several variables influencing the specific force, energy requirement of surface quality.

This textbook is an attempt to convey both definitive and practical information concerning wood machining to persons interested in the various problems of wood machining. The topics were treated with the view in mind of presenting as much physical information as possible without excessive mathematical manipulation.

A distinct strength of this book is that it draws on truly international literature and not only English language research publications. At the same time, considerable part of this book relies on own research works.

The authors are especially indebted to Professor G. Sitkei for reading the completed manuscript and offering many useful suggestions.

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