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Fritz Klocke

# Manufacturing Processes 4

Forming

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# Foreword to the Compendium “Manufacturing Processes”

Key factors in the quality and economic efficiency of industrial production are the choice of manufacturing processes and their design. Manufacturing technology is an elementary part of the basic knowledge of mechanical engineers. Also design engineers must gain knowledge of this field since they are highly responsible for the manufacturing costs. However, students as well as practising experts willing to enhance their knowledge experience difficulty in obtaining information. To the present day, there is no extensive yet clear description of manufacturing processes focusing on the technology itself.

In order to counter this necessity, the present compendium is meant to present an overall picture of the most common machining and non-machining manufacturing processes. In addition to the description of techniques, these volumes seek to deliver an insight into the underlying principles whenever it is necessary for the understanding of the processes.

The design of machine components, drives and controls is dealt with elaborately in the book “Machine Tools” from M. Weck/C. Brecher. W. Eversheim and G. Schuh go into detail about questions concerning cost-effectiveness as well as an optimized integration of machines in the production process in “Organisation in Production Techniques”.

Techniques with similar active principles have been grouped together into the following volumes:

Volume 1: Turning, Milling, Drilling

Volume 2: Grinding, Honing, Lapping

Volume 3: Electrical Erosion and Hybrid Processes

Volume 4: Forming

Volume 5: Casting, Sintering, Rapid Prototyping

At the beginning of the first volume is appended a section spanning all branches on the subject of tolerances and the workpiece measuring techniques used in manufacturing.

Within the individual volumes, we have tried to avoid an encyclopaedic listing of the methods. The book series is primarily intended for junior scientists in the fields of manufacturing technology and construction. In addition, the practitioner will be able to refurbish or extend his knowledge. The variety of manufacturing

problems is as large as the multiplicity of products, and manufacturing problems cannot be solved with textbooks alone. We hope that this book offers starting points and approaches to its readers, points upon which they can come up with their own successful solutions using an engineer’s way of thinking.

Aachen, September 2008

Fritz Klocke

# Foreword to Volume 4, “Forming”

The present volume of the compendium “Manufacturing Processes” deals with manufacturing methods of bulk and sheet forming. This book is based on the lecture series “Manufacturing Technology II” and the associated theoretical and practical exercises which I hold at the RWTH Aachen. In the process of revising the entire book series, the volumes “Massive Forming” and “Sheet forming” were combined to make the single volume “Forming”. The contents were also expanded, updated and restructured.

The chapters on massive and sheet forming are preceded by a chapter on “Basic Principles”. Therein, forming basics are addressed as well as methods of calculating problems in forming technology. The finite element method (FEM) is introduced as an important tool for analyzing complex forming processes using examples of its application. Methods of analyzing materials and components are introduced, as well as ways of determining material properties—especially flow curves. We present all tool and workpiece materials frequently used in all forming processes including the basic tribological aspects of forming engineering.

The chapter “Massive Forming” is dedicated to the most common processes of cold, warm and hot forming. It includes, among others, the processes of upsetting, impact extrusion and forging as well as superplastic forming and thixoforging. This chapter also addresses rolling as a finishing process. The chapter “Sheet Forming” contains the fundamentals required to analyze sheet forming processes. Among others, it includes the processes of deep drawing, stretch drawing, metal spinning and bending as well as several special sheet forming techniques.

The cutting processes of blanking and fine blanking are given a detailed presentation in the chapter “Sheet Metal Cutting”. Finally, the chapter “Joining by Forming” deals with punch rivetting, crimping and seaming.

For their assistance in the production of this volume, I would like to thank my assistants and employees, Dr.-Ing. V. Bäcker, Dr.-Ing. B. Feldhaus, Dipl.-Ing. P. Mattfeld, Dipl.-Ing. F. Schongen, Mrs. M. Schröder, Dipl.-Ing. Dipl.-Wirt.Ing. M.Sc. M. Terhorst, Dr.-Ing. A. Timmer, Dipl.-Ing. Dipl.-Wirt.Ing. D. Trauth and Dipl.-Ing. M. Zimmermann, who substantially contributed to the appearance of the English translation of this book. I would also like to extend my thanks to my former assistants who contributed to the previous editions of the volumes upon

which this book is based, "Massive Forming" and "Sheet Forming", and who now have leading positions in industry. Furthermore, I want to thank Springer for the thorough inspection of the manuscript.

Aachen, December 2012

Fritz Klocke

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