

Springer

Handbook *of*

**Mechanical
Engineering**



Grote
Antonsson
Editors

**Springer Handbook
of Mechanical Engineering**

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Springer Handbook of Mechanical Engineering

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With DVD-ROM, 1822 Figures and 402 Tables



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Preface

Mechanical engineering is a broad and complex field within the world of engineering and has close relations to many other fields. It is an important economic factor for all industrialized countries and the global market allows for wide international competition for products and processes in this field. To stay up to date with scientific findings and to apply existing knowledge in mechanical engineering it is important to renew and continuously update existing information.

The editors of this *Springer Handbook on Mechanical Engineering* have worked successfully with 92 authors worldwide to include chapters about all relevant mechanical engineering topics. However, this Handbook cannot claim to cover every aspect or detail of the mechanical engineering areas or fields included, and where mechanical engineers are currently present and contributing their expertise and knowledge towards the challenges of a better world. However, this Handbook will be a valuable guide for all who design, develop, manufacture, operate, and use mechanical artefacts.

We also hope to spark interest in the field of mechanical engineering from others. In this Handbook, high-school students can get a first glance at the options in this field and possible career moves.

We, the editors, would like to express our gratitude and thanks to all of the authors of this Handbook, who

have devoted a considerable amount of time towards this project. We would like to thank them for their patience and cooperation, and we hope for a long-lasting partnership in this ambitious project. We would also most sincerely like to thank our managers and friends at Springer and le-tex. The executives at Springer-Verlag were always most cooperative and supportive of this Handbook. Without Dr. Skolaut's continuous help and encouragement and Ms. Moebes' and Mr. Wieczorek's almost daily requests for corrections, improvements, and progress reports it would have taken another few years – if ever – to publish this Handbook. Stürtz has done a fantastic job in printing and binding. Finally we would like to thank all the people we work with in our departments and universities, who tolerated the time and effort spent on this book.

Finally, we know that there is always room for improvement – with this Handbook as with most engineering products and approaches. We, as well as the authors welcome your fair hints, comments, and criticism. Through this Handbook and with the authors' efforts, we would also like to draw your attention to what has been accomplished for the benefit of the engineering world and society.

Berlin, Fall 2008
Pasadena, Fall 2008

Karl-Heinrich Grote
Erik K. Antonsson

About the Editors

Dr. Karl-Heinrich Grote is a Professor and Chair of the Department of Mechanical Engineering – Engineering Design at the Otto-von-Guericke University in Magdeburg, Germany. He earned his “Diploma in Mechanical Engineering” (Masters of Science in Mechanical Engineering) in 1979 and his “Dr.-Ing.” (Ph.D. in Engineering) in 1984, both from the Technical University in Berlin, Germany. After a post doctoral stay in the USA he joined an automotive supplier as manager of the engineering design department. In 1990 he followed a call to become full professor at the Mechanical Engineering Department at the California State University, Long Beach, USA. In 1992 he received the TRW Outstanding Faculty award and in 1993 the VDI “Ring of Honor” for his research on Engineering Design and Methodology. In 1995 he was named chair of the Engineering Design Department at the Otto-von-Guericke University in Magdeburg, where he is now Dean of the College of Mechanical Engineering. From October 2002 to September 2004 he was Visiting Professor of Mechanical Engineering at the California Institute of Technology (Caltech) USA. Since 1995 he is Editor of the DUBBEL (Taschenbuch für den Maschinenbau) and author of several books.



Dr. Erik Antonsson is a Professor of Mechanical Engineering at the California Institute of Technology in Pasadena, where he organized the Engineering Design Research Laboratory and has conducted research and taught since 1984. He earned a Bachelor of Science in Mechanical Engineering from Cornell University in 1976, and a PhD in Mechanical Engineering from the Massachusetts Institute of Technology, Cambridge in 1982. In 1984 he joined the Mechanical Engineering Faculty at the California Institute of Technology, where he served as the Executive Officer (Chair) from 1998 to 2002. From September, 2002 through January, 2006, Dr. Antonsson was on leave from Caltech and served as the Chief Technologist at NASA’s Jet Propulsion Laboratory (JPL). He was an NSF Presidential Young Investigator (1986-1992), won the 1995 Richard P. Feynman Prize for Excellence in Teaching, and was a co-winner of the 2001 TRW Distinguished Patent Award. Dr. Antonsson is a Fellow of the ASME, and a member of the IEEE, AIAA, SME, ACM, and ASEE. He has published over 110 scholarly papers in the field of engineering design research, has edited two books, and holds eight U.S. patents.



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