Third edition of the high-performance mechatronics text/reference book

This month, the third revised edition of "The Design of High Performance Mechatronics" was published by IOS Press. This book by mechatronics veterans Robert Munnig Schmidt, Georg Schitter, Adrian Rankers and Jan van Eijk deals with the special class of mechatronics that has enabled the exceptional levels of accuracy and speed of high-tech equipment applied in the semiconductor industry, realising the continuous shrink in detailing of micro-electronics and MEMS. The book was published in 2011 and first revised in 2014. Now, the new edition contains updates concerning motion control, dB scales in Bode plots, and the SI redefinition.

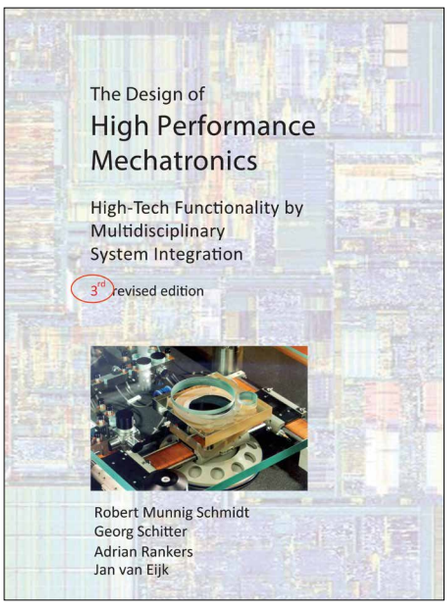
In addition to the 'standard' mechatronics subjects of dynamics, motion control, electronics and electromechanics, this book includes an overview of systems engineering, optics and precision measurement systems, in an attempt to establish a connection between these fields under one umbrella. The book distinguishes itself from other textbooks on mechatronics in several ways. First of all, it is a combination of a reference book for engineers working in the high-tech industry and a university textbook, due to the mixed industrial and academic background of the authors.

The industry-oriented part is based on extensive experience in designing the most sophisticated motion systems presently available, the stages of wafer scanners, which are used in the semiconductor industry. The academic part is based on advanced research on precision motion systems, including ultra-precision metrology equipment with fast scanning probe microscopy and optical measurement systems with sub-nanometer accuracy.

From its high-tech industrial background, the book focuses on high-precision positioning at very high velocity and acceleration levels. With this focus, the book does not include examples from other important application areas like robotics, machining centres and vehicle mechatronics, though the theory is also applicable to those areas of mechatronics. The presented material is aimed at obtaining maximum understanding of all dynamic aspects of a motion system, which is the reason for the term 'High Performance' in the title. It covers all relevant fields of expertise that support the focus area, including optics and measurement technology.

Most changes to the previous edition have been made in Chapter 4 on motion control, where the focus in feedback control has been shifted from pursuing a target bandwidth to a targeted low sensitivity for disturbances in combination with high-accuracy feedforward control using a solid trajectory planning, which is more in line with industrial practice. For this reason, the PID guidelines have been replaced by design steps that also include optimisation with loop shaping.

The presentation of 'poles and zeros' and the different kinds of impedances has moved to the physics chapter, as they are applied in various chapters. Another change is the addition of a dB scale next to the absolute magnitude scale in the Bode plots of the motion control chapter, because it has often been mentioned that the use of dB is as common in the control community as it is in the electronics community.
The redefinition of the SI base units in May 2019 required slight changes in some numbers and it further appeared useful to mention the units with the equations to avoid confusion.



Robert Munnig Schmidt, Georg Schitter, Adrian Rankers and Jan van Eijk, "The Design of High Performance Mechatronics – High-Tech Functionality by Multidisciplinary System Integration", 3rd revised edition, hardcover, 948 pages, ISBN 978-1-64368-050-7 (print), ISBN 978-1-64368-051-4 (online), €135 / US$166 / £122 excl. VAT, IOS Press.

Due to the addition of several subjects also some pruning of 'ancient' technology has been done. Especially the large part on linear power amplifiers has been reduced to the bare minimum, because at present almost all power amplifiers apply switched-mode technology. Finally, the "Main Design Rules for Precision" section, which was omitted from the second edition, returns at the end of the book after a complaint of an enthusiastic reader who worked with both the first and second edition, stating that he really used these design rules.

Authors

Robert Munnig Schmidt is emeritus professor in Mechatronic System Design at Delft University of Technology (NL) with industrial experience at Philips and ASML in r&d of consumer and high-tech systems. He is also director of RMS Acoustics & Mechatronics, doing r&d on actively-controlled low-frequency sound systems. Georg Schitter is professor in the Automation and Control Institute (ACIN) at Vienna University of Technology (Austria) with a standing track record in research on the control and mechatronic design of extremely fast precision motion systems such as video-rate AFM systems. Adrian Rankers is managing partner of Mechatronics Academy, developing and delivering high-level courses to the industrial community, based on industrial experience at Philips. He also teaches mechatronics at the Eindhoven University of Technology (NL). Jan van Eijk is emeritus professor in Advanced Mechatronics at Delft University of Technology. He is also director of MICE and partner at Mechatronics Academy, acting as industrial r&d advisor and teacher with experience in r&d at Philips.

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