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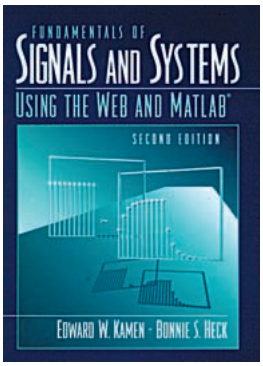
***Robot Force Control*** by Bruno Siciliano and Luigi Villani, Kluwer Academic Publishers, Boston, MA, 2000, 159 pp, $115.00, ISBN 0-7923-7733-8. *Reviewed by Yasmina Bestaoui.*

Manipulation tasks involve the interaction of a robot arm with the environment, and since manipulation implies contact with the environment, the resulting motion is constrained. Both position and force control of the end-effector are important for such applications, and this book discusses force control strategies for managing the interaction with a more or less compliant environment. Strategies that do not require an accurate model of the system are considered. Proper execution of constrained-motion tasks can be achieved by control systems that attempt to accommodate unplanned external forces. If direct measurements of the contact force are used in the control strategy, the information supplied by the force sensors may help compensate for the lack of knowledge of the real world.


The book is divided into five chapters, each with experimental results. The first is a brief introduction that discusses motion control versus interaction control and indirect versus direct force control. Force/position control strategies provide an effective framework for dealing with tasks that involve interaction with the environment. Chapter 2 describes the motion control problem and the kinematic and dynamic modeling of a robot manipulator. Tracking control and redundancy resolution in the task space are also discussed. Chapter 3 is concerned with indirect force control and considers compliance control and impedance control. Six-degree-of-freedom impedance control is introduced, and the rotational impedance equations are calculated for the Euler angles, the angle/axis, and the quaternions formulation of the orientation. Chapter 4 addresses direct as opposed to indirect force control. Manipulation tasks are specified in terms of direct requirements on both position and force variables; in this case, simultaneous direct control of the end-effector position and of the interaction force is necessary. Chapter 5 covers advanced force and position control in the task space. Dynamics in Cartesian space are derived, and an adaptive approach to the force and position control schemes is introduced. Regulation is analyzed first, followed by passivity-based control. The latter approach has some robustness properties with respect to inverse dynamics control. Full state feedback of the contact force and the end-effector position and velocity is required in this approach. The chapter concludes with output feedback control without joint velocities measurement. There are two appendices: one on rigid-body orientation and another on the kinematic and dynamic models of both robot manipulators used in the experiments.

***Fundamentals of Signals and Systems Using the Web and MATLAB*** (2nd edition) by Edward W. Kamen and Bonnie S. Heck, Prentice-Hall, Englewood Cliffs, NJ 2000, 722 pp, ISBN 0-13-017293-6. *Reviewed by Chris Bissell.*




This introduction to signals and (linear) systems covers the basics of continuous and discrete-time approaches: system and signal types; system models using differential and difference equations; continuous and discrete convolution; frequency-domain models; Fourier, Laplace, and z-transforms; and state representations. Two features set it apart from others: the wide range of applications considered, which include telecommunications and control, as well as the more usual analog and digital filter design; and its companion Web site at http://users.ece.gatech.edu:80/~bonnie/book/, where both MATLAB code and Web-based simulations and demos can be found.

The book is written in an approachable style while still maintaining the rigor that is so vital in this subject area, and only modest mathematical knowledge is assumed (two appendices review complex numbers and matrices). Students are encouraged to use MATLAB in tackling the examples and exercises (an online tutorial is provided for those unfamiliar with MATLAB). The decision to include an introduction to such topics as modulation theory, root locus, and digital filter and controller design allows students to appreciate the wide application of linear systems theory—although the depth of treatment of these topics is limited in an introductory text.

Students and instructors alike will appreciate the online demos.While the quality is not quite up to the highest current standards of computer-aided learning, many of the demos are highly