Essentials of Mechatronics

Essentials of Mechatronics

John Billingsley
University of Southern Queensland
Queensland, Australia

A John Wiley & Sons, Inc., Publication

Published by John Wiley & Sons, Inc., Hoboken, New Jersey.
Published simultaneously in Canada.

Library of Congress Cataloging-in-Publication Data:

Billingsley, J. (John)
Essentials of mechatronics / by John Billingsley.
p. cm.
Includes bibliographical references and index.
ISBN-13 978-0-471-72341-7 (cloth)
ISBN-10 0-471-72341-X (cloth)
1. Mechatronics. I. Title.
TJ163.12.B55 2006
621–dc22
2005032762

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

Contents

Preface

There are many definitions of mechatronics, but most involve the concept of blending mechanisms, electronics, sensors, and control strategies into a design, knitted together with software.

With an abundant wealth of topics to choose from, authors of mechatronics textbooks are tempted to bundle them all into a massive compendium. This book seeks to throw out all but the essentials; although perhaps in hanging onto the baby, some bathwater will still remain.

There are a hundred ways of achieving all except the simplest of mechatronic design tasks. At every step, choice and compromise will be involved. Should a precision motor be used, or will a simple sensor and a sprinkle of feedback allow something cheaper and easier to do the trick? What does the end user ask for, really want, actually need—or eventually buy?

Specialists can handle the fine detail, the composition of the molded plastic, the choice of components for the electronic interface, machining drawings, embedded computer, or software development platform. At the top of the pyramid, however, there must be a mechatronic designer capable of making the design tradeoffs that will transform a client's demands or a bright idea into a successful commercial product.

In some ways, mechatronics is as much a philosophy as a science. At its heart is a way of looking at tasks that will, if necessary, achieve their objective by ducking aside into an alternative technology. The mechatronic engineer knows where to look for the side roads and has a shrewd idea of the merits of the diversion.

Acknowledgments

This book is the result of so many influences that there is a danger of this becoming the longest section. Perhaps I should start with the engineers of the autopilot industry who introduced me to the practical aspects of control system design. Laury Ambrose and Mike Skinner left me in no doubt as to their opinions of the quality of the servo loop designed with my new graduate academic skills.

Later, John Coales filled me with enthusiasm to research abstruse control methods such as fast-model predictive control. My team of Cambridge researchers, including David Hedgeland, John Moughton, Matthew Dixon, and Roger Kinns, led the charge to embed processor boards in the most unlikely applications.

In Portsmouth, life became even more exciting. Mechatronics and robotics abounded with the help of Harjit Singh, Fazel Naghdy, David Harrison, David Sanders, David Robinson, and many others. Arthur Collie lent the wisdom of years in industry to a passion for walking robots. Tim Dadd, now my son-in-law, joined me in meeting the problems of running a company that designed software for embedding in mass-produced appliances.

Australia has been fun. Sam Cubero, Jason Stone, Matt Petty, Stuart McCarthy, Brad Schultz, and others all pushed robotics forward, while Mark Phythian has taken up the cudgels of running Micromouse and Bilby contests. Mark Dunn has thrown himself into vision research, with more practical applications than you can shake a stick at.

The achievements and energy of my children Berry-Anne, Richard, and William have all helped to keep up my enthusiasm, while my wife Rosalind's play-writing successes have sometimes diverted my time to thespian activities.