Preface

Engineers are professional inventors, researchers, and developers. Education imbues each engineer with discipline-specific knowledge. Combining the different disciplines allows engineers to solve more complex problems.

A design project has a fixed time frame, allocated resources, and defined outcomes. There are many books about project management without the engineering context. And, most project management books are for working professionals who have a few years of project management experience. Most design books pay minimal attention to project management. To make engineering students more effective, an integrated approach to project management and creative design is necessary.

This book represents a compilation of essential resources, methods, materials, and knowledge developed and used over 2 decades of teaching project-oriented courses. It is for engineering students taking courses with technical design projects. Students who do project work in parallel with the book can benefit greatly. Reading chapters out of order, or omitting some chapters entirely, can accommodate unique curricula. Readers can find technical examples specific to their disciplines and to other forms of engineering. This book uses methods and knowledge that are applicable to all disciplines. A mixture of cross-discipline and discipline-specific examples relates application knowledge to the multidisciplinary field of engineering design projects.

The best approach to design project education is to actually do projects; students or professionals should work on technical problems at the same time they are reading the book. Read Chapter 1 for an overview of the design project process. The remaining chapters can be read in any order, suited to the course or project. For example, some instructors might choose to omit the "People and teams," "Communication, meetings, and presentations," or "Customer requirements and specifications" chapters. Some chapters are for smaller audiences, such as Chapter 10, "General design topics," which is aimed at all engineering disciplines.

The construction of the book supports the comprehension and use of engineering theory in applied practice.

Notable features include the following:

- There are many figures and clear procedural steps, which support learning and application.
- Abstract and concrete learning styles are accommodated with parallel text and/or figures for each concept.
- Visual models provide a foundation for knowledge. Flowcharts illustrate decision-making examples, office procedures, and human relations.
- Many methods are illustrated with tables so that they can be done using spreadsheet software.
- Some critical topics are discussed in depth. Other topics provide enough description to understand the strategic importance of the methods, and prepare the reader to quickly locate, and use, learning resources.
- Chapters are concise and focus on design project skills (Fig. 1).
- The sequence of the chapters supports a relatively generic project sequence for just-in-time learning. However, instructors may change the chapter sequence as necessary.
- The book is intended for a multidisciplinary audience. There is an assumption that readers have a strong grounding in their chosen discipline and are in need of an integrative experience.

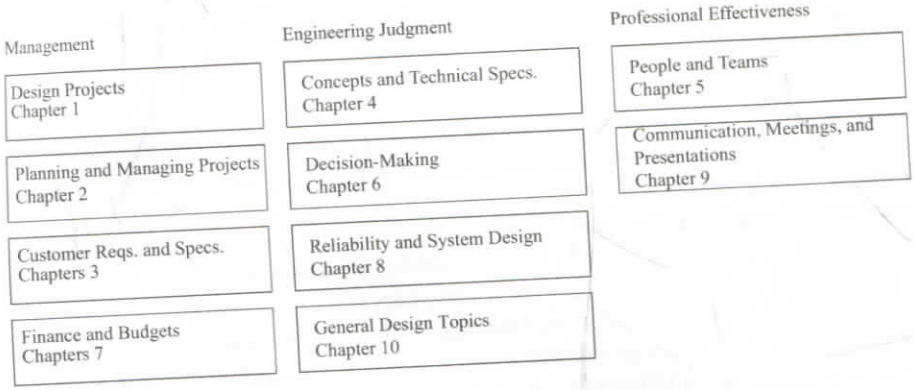

FIGURE 1
The big-picture outcomes.

- Short single-sentence axioms highlight key concepts.
- Cases and examples bring the concepts to life.
- Simpler problems are placed throughout the chapters to allow readers to test their knowledge as they read. Problem solutions are available on the support website: http://www.engineeringdesignprojects.com.
- Professional engineering topics in most chapters include human factors, law, ethics, and communication. These topics prepare engineers to collaborate with peers and eventually manage employees, budgets, customers, and more.
- Accredited and certified engineering programs can benefit from topics ill suited to traditional courses. The chapters of the book correlate to engineering and technology accreditation criteria. Appendix C provides a map to accreditation criteria for a few bodies such as ABET and CEAB.
- The book uses système internationale (SI) units. Imperial (English) units appear when appropriate.
- A tutorial on using Microsoft Project is provided for project management tasks.

This book is multidisciplinary in nature and benefits from the author's extensive background, which includes a bachelor's degree in electrical engineering and master's and PhD in mechanical engineering. Professional work in manufacturing, automation, and robotics brings a solid understanding of manufacturing engineering. In addition, the author has had over 2 decades of teaching experience with industrial, academic, course, thesis, and capstone projects. These have resulted in hundreds of projects for industrial sponsors at the undergraduate and graduate levels. The project types have included new product designs, test equipment, production equipment, and applied research.

ANCILLARIES

Instructors using this text for a course can find useful support materials, including electronic images from the text, recommended schedules for projects, and other resources, by registering at textbooks.elsevier.com.

For readers of this text, additional materials such as forms, checklists, and spreadsheets discussed in the book are available at https://www.elsevier.com/books-and-journals/book-companion/9780128210550. In addition, the author maintains a book-related website with selected materials at www.engineeringdesignprojects.com.

ACKNOWLEDGMENTS

This book has benefited from constructive comments and suggestions from the following reviewers, as well as several additional anonymous reviewers. The author takes this opportunity to thank them for their contributions.

- Kamal Amin, Florida State University
- Samuel Bechara, Colorado State University
- Peter Childs, Imperial College
- Shabbir Choudhuri, Grand Valley State University
- Irena N. Ciobanescu Husanu, Drexel University
- Ed Cydzik, San Jose State University
- Dan Dolan, South Dakota School of Mines and Technology
- Jan Gou, University of Central Florida
- John Farris, Grand Valley State University
- Sebastien Feve, Iowa State University
- Alicia Jack, Haywood Community Collete
- Anthony D. Johnson, University of Huddersfield
- J. Carson Meredith, Georgia Tech
- Curtis O'Malley, New Mexico Institute of Mining and Technology
- Christopher Pung, Grand Valley State University
- Ramin Sedaghati, Concordia University
- Joshua D. Summers, Clemson University
- X. Jack Xin, Kansas State University
- Robert T. Balmer, University of Wisconsin–Milwaukee (Emeritus)
- Tariq Tashtoush, Texas A&M International University

The author would also like to thank Steve Merken, Senior Acquisitions Editor; Rukmani Krishnan, Project Manager; Ali Afzal-Khan and Chris Hockaday, Editorial Project Managers; and Valerie Koval, Copy Editor, for helping guide the project through to publication.