book is said to be intended for newcomers in practice and for senior-level students. However, it will surely prove to be a standard reference even for experienced engineers.

Preliminary drafts of the various chapters were reviewed by individual experts. The list of these reviewers is virtually an honor-roll of the leaders in process heat transfer. Their participation gives this book an aura of authority over a very broad range, while at the same time the singular authorship provides a greater consistency than is ordinarily accomplished in a compilation of contributions by many authors.

The book is profusely and well illustrated, which is essential for descriptive purposes. Attention in the questions and answers is focused on the choice of various types of equipment for different applications. Although some quantitative information is given in connection with such choices, procedures of design for specific equipment are not included. Such procedures of course provide the primary content of conventional books on heat transfer and process design.

Quantities are given in English units with the SI equivalent in parentheses, or vice versa, depending on the original source. A detailed table of contents and a very complete index are essential for a book of this type in which the reader will be searching for information on a few special matters rather than reading from cover to cover. Spot tests indicate that both the table of contents and the index meet this standard, although omissions were noted in the latter. For example, the "effectiveness factor" and the "correction factor" do not appear as primary items.

Fluidized beds, direct-fired boilers, cooling towers and regenerators were arbitrarily excluded, but otherwise the book is very comprehensive. Individual topics are necessarily limited in scope and thereby incomplete. For example, the discussion of spiral heat exchangers does not mention the inapplicability of the log-mean temperature difference owing to two-way heat exchange at each point of each passage.

Despite the minor omissions noted above, this book is remarkably complete and generally sound. The format of questions and answers proves to be surprisingly successful and convenient. Students in process design will find this volume to be an essential resource, and practicing engineers will find it an invaluable reference.

The author and the publisher are to be commended for producing an imaginative and useful contribution in a mature field.

Despite the overly generous statement in the acknowledgement, my contribution to the concept was only in terms of encouragement, and to the content only as a reader. Hence, I offer the above remarks objectively as a potential user. □

PRINCIPLES AND PRACTICE OF AUTOMATIC PROCESS CONTROL

by Carlos A. Smith and Armando B. Corripio, John Wiley and Sons, $43.95, 1985

Reviewed by
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This text is designed to present classical control theory and practice to senior level students and industrial practitioners. The text focuses on single variable control loop design for continuous processes using examples from the chemical process industries. The topics covered are the same as have been included in popular chemical engineering control texts for over twenty years.

The authors have prepared a text comparable to the classic by Coughanowr and Koppel. They have succeeded in their goal of preparing a text with both principles and practice. However, with the recent advances in control theory and practice, the text should include coverage of batch process control, programable controllers, adaptive control, discrete control, distributed and computer control. Many of the above topics have been included in texts for other fields since the early to mid '70's. It is imperative that chemical engineering control texts include the more modern topics and that these be included in the curriculum. The field cannot continue to cover the same topics as were covered in the past and meet the needs of our graduating engineers or the industrial users.

The text can be divided into six major sections: mathematical basics, process dynamics, control system components, single loop control system design, and additional control techniques. The section on mathematical basics covers Laplace transforms, linearization, and complex variables. The Laplace transform and linearization sections are well-written and should provide the reader with the mathematical foundation to use the techniques in controls and other areas. The linearization section includes both single and multi-variable methods with applications to typical control problems. The section on complex numbers is very short and probably should be expanded to give students an adequate background.

Chapters 3 and 4 introduce the development of transfer functions for typical first order systems along with the system response to input disturbances.

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This is a verbatim transcription of Guggenheim's Eqs. 5.60.6 and 6.60.7.

Guggenheim's explicit purpose in his Section 5.60 was to derive rigorous, general formulae in regard to the effect of pressure and temperature on interfacial tension, in two-phase systems, that were "applicable to any interface in any system of two components." He noted, however, "We warn the reader that these formulae are too complicated to be of any use." Compare Ref. [5], for a rigorous treatment of the pressure coefficient of interfacial tension.

In view of the adoption of the error that I have noted, by so eminent a thermodynamicist as Guggenheim, surely a student who, un-warned, makes this mistake should not be cast into outer darkness. Thus, there is an obligation for teachers of chemical thermodynamics to caution against this error. And it would be, to say the least, desirable for workers in phase equilibria to be reminded of the Ibl and Dodge treatment in connection with testing vapor pressure data for self-consistency, via the Duhem-Margules equation.

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3. W. Hume-Rothery, "Structure of Metals and Alloys," Institute of Metals, London, 1947.
4. E. A. Guggenheim, *Thermodynamics*, 5th ed., North-Holland Publishing Co., Amsterdam, 1967, pp. 269-72.
5. R. J. Good and F. P. Buff, in *The Modern Theory of Capillarity*, F. C. Goodrich and A. I. Rusanov, eds., Akademie-Verlag, Berlin, 1981.

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Example problems are typical of the chemical process industries. Chapter 3 contains an excellent comprehensive introduction to block diagrams. However, this section seems out of place and disrupts the dynamic response presentation. Chapter 4 is primarily limited to non-interacting and interacting series of first order systems with just a brief mention of other higher order systems.

Chapter 5 is a discussion of control system components including the sensors and transmitters, the control valve, and the controller. The section on control valves includes design and selection procedures from two major valve manufacturers, a discussion of the control valve types, and the importance of including both the valve and piping system characteristics when selecting control valves. Appendix C provides a discussion of specific equipment and is a welcome addition to the text. The section on controllers includes a discussion of the major control modes along with pictures of different classical controllers. A major omission in this section is the absence of a discussion about programmable controllers.

Chapter 6 introduces the reader to closed loop control system response, control system stability, control system tuning, and control system synthesis. This section will be especially valuable to those practicing in plants with standard analog controllers.

Chapter 7 contains the classical single loop feedback control design procedures, including both the root locus and frequency response techniques. The root locus procedures are presented through the use of examples. The open loop frequency response techniques at times were confusing because of the symbology which is different than that often used in the literature. Closed loop response from the open loop response and the Nyquist procedures are briefly discussed. The chapter contains a section on pulse testing which should be expanded if it is to be of use to the reader. A rearrangement of material in Chapters 6 and 7 would improve readability of this major section.

Chapter 8 covers additional topics in control including ratio control, cascade control, a brief introduction to multivariable control and de-coupling, and an introduction to feed forward control. The coverage is sufficient to introduce the reader to the topic but is not sufficient for design purposes. A further limitation is the few references provided for further reading.

Chapter 9 is a brief introduction to the modeling of complex processes. It provides an overview of procedures to develop and solve the model and provides simple examples. As with Chapter 8, additional background will be required for use in design.

Appendix A contains the standard control sheet notation. Appendix B contains a series of case studies in control which are valuable for the student. Appendix D contains root finding programs written in FORTRAN. These are a valuable addition to the text.

The text contains numerous solved examples and has abundant problems at the end of each chapter. The problems are closely related to the topics presented.

The use of the first person was at times distracting to this reader. There were sections which could have benefitted significantly from a tightening of the presentation. Additional references for each chapter would be valuable for those wishing a more comprehensive discussion in specific areas. □