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Book reviews

Process Control Modules: A Software Laboratory for Control Design

Francis J. Doyle III, Edward P. Gatzke, Robert S. Parker (Eds.); Prentice-Hall, Englewood Cliffs, NJ, 2000, 152 pages (paperback with CD-ROM), ISBN 0-13-739897-2 ($49.00)

This is an interesting and unusual publication. It takes the form of a workbook with CD-ROM, rather than a traditional textbook (it even has eight pages of space for the reader — or should I say user — to make their own notes and calculations). The CD carries the main feature — a dynamic plant simulator package that has been tailored for interactive use in implementing control techniques in a process environment. If you have never had the chance to operate and control a real distillation column or furnace system, then this is about as close as you can get without a hard hat.

For the simulation buffs, the software is a MATLAB/SIMULINK implementation. A reasonably good approximation to a modern DCS control screen gives you access to the means of making manual changes to valves and set points, auto/manual transfer and all the things you might expect to do from a normal operator control panel. The only added feature is that if it all goes pear shaped you can stop and re-initialise. However, "random" noise is used to provide background process and measurement noise, so you cannot expect to repeat exactly the same moves twice. I had to jump out a few times initially whilst I got used to operating the interface and all the features available but the instructions are reasonably helpful if you keep at it.

The coverage is pretty wide, ranging from simple basics, e.g. gain factor determination, up to feedforward, IMC (inverse model control), discrete, and finally, model predictive control. You might wonder how Doyle manages to pack all this into 152 pages and the answer lies in the fact that this is a workbook, which allows you to apply techniques interactively on the basis of some fairly brief overviews. Where deeper explanation is needed, the author signposts you off to consult more conventional texts separately. The result is that if you are not already into modern process control concepts, you will need access to a substantial library to get the best benefit from the exercise. Of course this really reveals the prime target readership — the student chemical engineer, undergrad or postgrad alike. The text was designed around this audience, both as a good introduction to the use of MATLAB/SIMULINK as well as to control techniques.

There are some important prerequisites to note on computer platforms. The Preface to the book says "The Process Control Modules are a set of MATLAB/SIMULINK routines which require either a full license or the Student Version of MATLAB and SIMULINK" and "The minimum recommended system configuration is a 200 MHz Pentium Pro with 32 MB RAM (or equivalent UNIX machine)". Taking availability of these as read, the text is well graded leading incrementally from the basics to the heights. There are "fill-in-the-boxes" prompts and a host of exercise to work on. For those who want to take developments further, there are also some pointers to customising developments.

Quite a few text books now include electronic media with supporting calculations, examples, code segments, etc., but Doyle takes this a stage further and shifts the balance towards user interaction with the computer, with the text acting as a prompter. I do not think I could release my students on this until after a one semester introduction to control but for further emphasis and for more experienced practitioners to brush up with some "hands-on" practice in implementation, this is hard work but instructive, and if like me, you are already a MATLAB user, quite good fun.

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Elementary Principles of Chemical Processes

Third edition; Richard M. Felder, Ronald W. Rousseau (Eds.); John Wiley & Sons, Inc., New York, 2000, 675 pages, hardback, ISBN 0-471-53478-1 (£29.95)

Previous editions of Felder and Rousseau's book, followed and recommended over the years in chemical engineering departments all over the world, became classic texts. The new volume keeps the same structure when addressing scientific background but updates practical matters with current problems, which offer a global view of traditional and actual applications within chemical engineering.

Mass and energy balances, the cornerstones of every chemical process, constitute the core of the book. It is important to remark that new fields where chemical engineers are developing their professional careers, such as life

cycle studies, environmental assessment, energy auditing and process integration are clearly related to those topics.

The global structure of the whole volume, as well as the specific arrangement of each chapter, is consistent and enables its use as a reference textbook in basic chemical engineering courses. From the lecturer's point of view, the instructional objectives at the beginning of every chapter are helpful. In addition, the order and complexity grades of the exercises allow adaptation to courses of different scope and level.

For the students, the contents are presented in a modern, attractive way and are properly balanced. The unambiguous theoretical knowledge introduced is straightaway applied to real problem solving. Regarding didactic efficiency, there is a good balance between theory and practice and, with the aid of "test yourself" sections, the book encourages students to consolidate their knowledge step by step. Even more, helpful selected examples are solved with understandable methodology. The excellent problem collection at the end of every chapter also provides a useful reference for the students, who should achieve a global view of different fields within chemical engineering by the end of the course.

A notable aim of the authors is to use some of the key exercises to teach students the importance of an overall methodology for understanding and organising ideas, above and beyond the mere resolution of the particular issue. Especially remarkable in this sense is the section, "General Procedure for Single-unit Process Material Balance Calculations". This summarises some rules and procedural suggestions for a methodical solution of any problem. It is particularly important in such a course for the student to develop intellectual skills to focus analysis and problem solving.

As a conclusion and for use in advanced courses, revamped case studies presenting state-of-the-art problems have been included. Particularly noteworthy is the case of the "steam reforming of natural gas and subsequent synthesis of methanol". The flowcharts of this process challenge the student with the exciting task of integrating as a whole the knowledge acquired throughout the book.

Another interesting feature is the enclosed CD-ROM entitled "Interactive Chemical Process Principles". This is a guide and tool kit for students using the text, and also contains reference materials that should be useful when building the chemical engineering curriculum. Alongside conventional features, such as Physical Properties Database and the easy-to-use equation solving and graphing program E-Z Solve, it contains the Visual Encyclopaedia of Chemical Engineering Equipment. This enables readers to obtain a photograph and/or a cutaway view of common chemical process equipment, such as heat exchangers, pumps, separation process units and chemical reactors by clicking in the relevant section.

Summarising, this book, printed on acid-free paper, presents a meticulous layout including clear charts and graphics, is user friendly and can therefore be recommended as a textbook for basic chemical engineering purposes.

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Coulson & Richardson's Chemical Engineering — Vol. 1, Fluid Flow, Heat Transfer and Mass Transfer — 6th edition

J.M. Coulson, J.F. Richardson, with J.R. Backhurst and J.H. Harker, Butterworth-Heinemann 1999, 895 pp., Price £29.99 (paperback), ISBN 0-7506-4444-3

This invaluable six volume classic series has been a very useful tool for chemical engineering students and graduate engineers alike since its inception in the early 1950s. It has received regular updates over that period of time, with J.R. Backhurst and J.H. Harker joining the original team of Coulson and Richardson 20 years ago. This volume represents the fifth update/new edition in the last 10 years, reflecting the pace of change in the chemical engineering environment at the turn of the century. This has been done over the years with the necessary doubling in length since the 3rd edition.

Each of the six volumes is broken down into a number of coherent themes, with the main basic science behind practical transport phenomena (fluid flow, heat transfer and mass transfer) and dimensional analysis being covered in this volume (Volume 1). Additional information, from unit operations (e.g. particle technology, reaction engineering, separations) and design are available in Volumes 2, 3 and 6.

As has been the practice with this series over the years the style, examples and layout have been specifically focused at providing a good practical background to the aforementioned core areas of chemical engineering. A book of this nature, by covering a wider range of topics, does lose some detail that books with a narrower focus can and do cover. However the reference lists at the end of each chapter provide further (deeper) reading suggestions. There has been some limited updating of this list, although a great many older references are still present. Stylistically this series is easier for students to deal with than perhaps the more detailed "reference book" orientation of Perry's Chemical Engineers' Handbook [1].

With chemical engineering evolving into newer areas, updating of the curriculum is required. This text goes some way along this pathway, with important processes such as soft solids, for example, toothpaste and foods being treated in an expanded section on non-Newtonian fluids. In the same vein, an expanded examination of heterogeneous and homogeneous mass transfer with reaction systems is provided, thus providing a useful introduction to catalytic systems.

As one would expect with a series that has been developing over nearly 50 years, the layout and transfer of ideas to