

REVIEW: Economic Evaluation

Continued from page 5.

of process applications.

The book is broken down into six chapters with the first chapter giving a very simple survey of the principles of economic evaluation with many generalizations. The second chapter is on the subject of capital and is an adequate survey for providing overall information with few details. Chapter Three on production costs and Chapter Four on capacity economics are presented in the same general survey form as Chapter Two, with a very simplified description, a few illustrations, and definition of terms. Probably the most useful chapter in the book is the fifth chapter which deals with year-by-year economics. It is almost completely a word discussion, with no base equations being given for the relationships which are presented in the numerous examples. This chapter gives the general ideas of discounted cash flow, net present value, and year-by-year accounting, but very little useful quantitative information on the various methods is given. There is nothing included on income taxes or modern depreciation based on recent Federal laws.

The final chapter on computer processes is a very simplified presentation based on flow diagrams and block schedules. No examples and no problems are included. The book concludes with a seven-page glossary of terms and a twelve-page index.

The book can serve as a useful over-view for economic evaluation in the chemical process industries, but it would not serve as a teaching text because of the lack of quantitative information. The material it presents is given in easy-to-understand language with very little mathematics background required. It would be of use as an introduction to the subject for someone who needed to get an overall picture of the methods and basis of economic evaluation for industrial processes without getting into technical details. □

PRINCIPLES OF POLYMER SYSTEMS, 2ND EDITION

by Ferdinand Rodriguez; McGraw-Hill Book Company,
New York, 1982; pages xvi, 575, \$29.95

Reviewed by

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The first edition of this book appeared in 1970 as a text for polymer courses primarily in chemical engineering departments, although at that time not

many departments taught such courses. The second edition is part of the well-known and respected McGraw-Hill Chemical Engineering Series. This fact may be taken as one indication of the degree to which instruction in polymers has been incorporated into chemical engineering departments since 1970.

The second edition follows the same format as the first and is essentially an updated version of that book. While substantial progress has occurred in the science and technology of polymers during the years between the appearance of the first and second editions, the goal of the book is to present to the beginning student basic principles of the subject which largely remain timeless; however, all of the dated content of the first edition, such as production statistics, has been appropriately made current. The lengths of both editions are approximately the same so about the same amount of material was removed as was added. The main strengths of the new version are more problems at the end of various chapters, plus greatly expanded lists of specific and general references which should help introduce the student to the modern literature.

The first three chapters deal with basic issues of polymer molecular and physical structure to give a framework for understanding properties. The next three chapters are devoted to polymerization reactions and processes and the closely linked issue of the description and measurement of molecular weight and its distribution. The following three chapters deal with rheological behavior ranging from laminar flow of solutions and melts, to viscoelasticity at small deformations and finally ultimate failure properties of polymers under use-type conditions. The next chapter introduces the reader to other types of properties than mechanical ones with a strong, and appropriate, emphasis on electrical behavior. The following chapter deals with types and mechanisms of polymer degradation with equal focus on how these problems can be avoided or solved by the use of various additives. This is a feature unique to this textbook and is one of its really strong points. The reader is then introduced qualitatively to some of the common processing and fabricating techniques. The entire book could be made stronger at this point by more detailed analyses of some of these operations to show how rheological data, introduced earlier, can be used in practice and how molecular weight and its distribution is a powerful way of tailoring polymers for these specific processing methods. In turn, an excellent opportunity could have been provided to show the chemical engineering student how the latter ties to the polymerization mechanism, conditions, and process to give a glimpse of the strong interrelationship between each of these

Continued on page 46.

type work, or go on to graduate studies, provided that sufficient interest, a good first degree and funds are available to them. Furthermore, when the few industries we do have run into technical problems which require research and/or development, authorities in both government and industry turn to the more expensive foreign experts for help. They hesitate to make use of the talents of their own researchers and scholars (who are in most cases educated in the very same countries from which the technical assistance is sought).

Student population problems also seem to originate from a lack of healthy industries as well as a lack of technical training centers. High school graduates turn to colleges and universities as their only route to success and a rewarding future. However, the size and facilities of the institutions are limited and in most cases can accommodate a mere 5-10 percent of the applicants. The demand for higher education tends to overcrowd all institutions and especially the engineering schools, which are among the most popular ones. Faculty-student ratio is reduced and this causes deterioration of the quality of engineering education, as Murti and Murray-Lasso [3] pointed out. Another problem which places more of a burden on faculty members is the relatively weak foundation of entering students in chemistry, mathematics and physics. Although this problem could be solved if only the best students at the matriculation examination are selected for admission, a government policy requires preferential admission for candidates from the so-called "educationally less developed" areas. The result is poorly prepared students in our classes.

FUTURE PROSPECTS AND SUGGESTIONS

Even though the government has recognized the technological education problem, the present approach does not offer relief. Proliferation of ill-equipped institutions is not a solution. What is needed is:

- Improved technical training along the lines proposed by Abdul-Kareem and Silveston [1]. In addition, governments should discontinue the 'federal-character' or 'state character' policy in staff recruiting. A situation where a foreigner is preferred over a more-qualified fellow citizen, even one from a different section of the country, is an anathema.
- Improved relations between university communities and industrial centers. This would make industrial administrators and government policy makers aware of the potential talents available in Nigeria's own institutions. It would permit faculty members to gain practical experience through short-term or long-term industrial leaves-of-absence. The lecturers would also become conscious of chemical engineering problems which industries are fac-

ing and could, in turn, modify the contents of their courses and their educational programs accordingly. A closer relationship would open new avenues for chemical engineering students to get worth-while, on-the-job technical training during their years at the university. Since most industries in Nigeria are transnationals with chemical engineers active in the top echelons of management, perhaps they can help by urging branch plants to set up research and development departments and encouraging these departments to work together with universities.

- Effective research institutes and centres which can cooperate with our academic institutions and assist our industries with problems such as alternative raw materials for industries, energy resources planning, utilization and management, design and construction of industrial plants, pollution abatement, greater agricultural productivity, and food storage, to name the most obvious ones. Effective research institutions could make proper use of experts from other countries and attract Nigerian researchers and scientists who are living abroad towards solving problems of their country without having to return home. Funds for industrial research centers could come from government or from some of our own men of wealth, who now seem to squander their riches on frivolities.
- Foreign Support: Grants now offered for faculty fellowships by the U.S., Canada and Great Britain need to be redirected towards more urgent needs such as teaching and research equipment and books for our libraries.

REFERENCES

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2. J.A.M.B. Brochure 1985-86 Session (Guidelines for Admission to First Degree Courses in Nigerian Universities).
3. Murray-Lasso, M. A. (1972) "Engineering Education in Mexico," *IEEE Trans. Educ.* E-15 (4), 214-219.
4. Murti, (1972) *Ibid.*
5. Silveston, P. L. (1983) "ChE Education in the Third World—North American Assistance," *CEE*, Spring 1983, p. 78. □

REVIEW: Polymer Systems

Continued from page 33.

steps in the development of a final product.

After the general treatment outlined above, the student is introduced to specific polymers, their characteristics, and their uses in a chapter devoted to addition type polymers and another chapter on condensation type polymers. The final chapter deals with various analytical methods used in polymer characterization and identification. This serves as a brief introduction for the chemical engineer to some of the most common techniques likely to be encountered during making or using polymers.

The appendices are an especially useful feature of this book as they give literature sources, a number of laboratory exercises, and finally, an index of properties for the most common polymers. The latter may

be a convenient reference for the student after graduation.

While the number of textbooks in this area is much greater than it was in 1970, the second edition of Rodriguez should be given careful consideration when selecting a text. Its price is reasonable at \$29.95. □

ELEMENTARY PRINCIPLES OF CHEMICAL PROCESSES, 2nd Edition

by R. M. Felder and R. W. Rousseau

John Wiley & Sons, Somerset, NJ \$43.95 (1986)

Reviewed by

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Since this is the second edition of one of the more popular books for an introductory course in chemical engineering for sophomores, this review will try to address two audiences—those who are familiar with the first edition and who wish to know how it differs from the present one, and those who wish to compare this text with others on the same topic. At the start, it is fair to point out that at this university the text probably receives a more rigorous workout than at many other places since it is the basis for the major portion of two semester-long courses; consequently, many of the points of discussion may not even be noticed by those moving through the text at a more hurried pace.

For those unfamiliar with the book, it starts out with a few preliminaries, reminders of topics covered in previous courses, then moves to the fundamentals of material balances. The treatment is extremely thorough and step-by-step, from non-reacting, single species, single units to multiple reactions, multiple units with recycle, bypass, and (new to this edition) purge. Then follow the constitutive equations for relations in one or more phases, with examples showing their use in solving balances with data that is easier to obtain. The section on energy balances builds on material covered previously, and first shows how the simple forms of the general equation can be derived. This is followed by the constitutive relations defining specific heats, heats of reaction, heats of phase change, and heats of mixing, and their use in energy balances. Then come general chapters on computer-aided calculations (new) and transient processes. Finally, there is a set of case studies, different from those in the first edition. Each case study is a good example of a set of problems which can be either treated after all of the book material is covered or in discrete increments during the course. Either way, in

each case study there are one or two open-ended problems which serve as “capstones” for all of the material covered. At the end of every chapter there are numerous problems, with a good mix of calculator- and computer-type solutions. Liberally sprinkled throughout the chapter are a set of “Test Yourself” exercises with solutions, verifying that the student has understood the concepts, and a set of “Creativity Exercises” (new) to challenge budding engineers. Each chapter also contains a good number of worked examples of a wide range of difficulty.

In my mind, there were only a few, minor, negatives in the first edition, and many of these have been improved upon in this work. A notable example is the section on bubble and dew points, which has been greatly expanded and improved. The more formal treatment of the degrees of freedom and its relation to the number of unknowns and the number of equations in a given system is most appropriate. There is also a much better treatment of the concepts of fractional conversion and stoichiometric coefficient. However, the treatment of the heat of solution with reference to an infinitely dilute standard state would be a good candidate for further expansion together with, perhaps, a worked example of significant difficulty. More significantly, in the treatment of material balances there is a new section on thermodynamic equilibrium that I believe the book could have done without. The parameter defined is not the Equilibrium Constant and will almost certainly lead to confusion in subsequent courses in thermodynamics, particularly with respect to equilibrium in multiple phases. Further, in the treatment of energy balances I am not particularly in favor of the Table format used, where component amounts and enthalpies in the inlet and outlet streams are listed. This is useful only after the numbers are obtained and does little to explain how this is done. I would rather see more extensive use of the diagrams of hypothetical steps in going from inlet to outlet conditions. Finally, in the treatment of transient balances, I would have liked to have seen a greater emphasis on problems requiring the solution of (simple) differential equations—for instance with semibatch operations—instead of a rehashing of integral batch analysis. I would also have liked to have seen more continuity between material balances and energy balance transient problems—for instance, the chemical reactor and batch distillation treated from the energy balance point of view.

These drawbacks are more than compensated by the many advantages of both editions of the book. It is written in a clear, direct, almost conversational style; a wide range of material is covered in relatively

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