tion coefficients treats two modes of operation including single stage and countercurrent extraction. Calculation procedures for fractional extraction cascades are developed by algebraic expressions of the Kremser type and graphical techniques. Several variations of the countercurrent cascade including multiple feed, multiple solvents and extraction with reflux are discussed.

Binary distillation is discussed next. It is the first separation process that is considered which has a nonlinear equilibrium relationship. Expressions for the operating lines are developed for the rectifying and stripping sections by utilizing the constant molal overflow assumption. Stage to stage calculations are illustrated by using numerical values of equilibrium composition obtained from an x, y diagram. An extensive treatment of the McCabe-Thiele diagram then follows with detailed discussions of feed plate location, feed quality, minimum reflux, partial and total condensors (and reboilers), and multiple feed and product streams. Several methods of handling the case of variable molal overflow are then discussed. Finally the economic balance of operating costs versus column investment costs is discussed in enough detail for the student to appreciate the subtleties of the trade offs that are involved.

The final chapter on multicomponent distillation is far beyond the scope of most introductory courses in chemical engineering. The discussion of Lewis-Matheson method is appropriate since it is a direct extension of the binary case with variable molal overflow. The discussion of the Thiele-Geddes procedure illustrates the incentive for digital computation to perform the interative calculations associated with multicomponent distillation.

The Underwood equations for minimum reflux are presented early in the chapter on multicomponent distillation and are typical of the rather advanced level of presentation. First year graduate students often have difficulty applying these equations. This treatment would be particularly evasive for students in a first course in chemical engineering. The only incentive seen by this reviewer for discussion of multicomponent distillation in an introductory course is to illustrate the importance of digital computation.

The major strengths of this text which justify its use in an introductory course are: 1) The choice of subject matter, separation processes, is central to all chemical engineering practice, 2) the level of mathematical treatment is easily within the grasp of the freshman or sophomore student, and 3) economic considerations are introduced early and should give the student some perspective on engineering decision making.

Many schools will find it difficult to devote their first chemical engineering course entirely to staged cascades. Other perhaps more basic concepts such as physical and chemical material balances with recycle and energy balances often require extensive illustration and practice. The chapters on washing and extraction certainly provide an effective introduction to staged separation processes. While mathematical developments throughout the text are accessible to beginning students many of the physical concepts in the latter sections would be excessively difficult for many beginning students.

In addition to use in a beginning course this text should find application in more advanced undergraduate courses, e.g., we base one of our junior design projects on a process similar to the mud washing problem of chapter 2. This text could also be recommended to first year graduate students whose undergraduate education is not in chemical engineering.

Environment, Power, and Society, Howard T. Odum, 331 pp., Wiley-Interscience, New York, 1971. Carl N. Shuster, Jr., Office of Environmental Quality Federal Power Commission.

This exciting, powerful book immerses the reader in a profound discourse on the macroscopic approach to understanding the environment and society. It explains the methodology of the approach and urges the reader to use it in attempting broad interpretations of all kinds of interrelationships among major components of this Earth, including large-scale problems affecting human society. It is the type of book that should be read first to become acquainted with its overall message; application of this message comes later, after the methodology has been assimilated in some detail.

Although "intended for the general reader . . .," probably more than one reader will have to discipline himself to stay with the book, for it presents a formidable array of ecological concepts, mathematical formulations, electrical circuitry analogs, etc., and their pertinence to societal problems. Yet, one will stay with it if one takes the author's words to heart: one need be neither biologist, engineer, or humanist; one need only to see the value of and utilize the macroscopic

ChE news

BRINK CHAIRMAN AT WASHINGTON STATE

Dr. Joseph A. Brink is the new chairman of the Department of Chemical Engineering at Washington State University, Pullman, Washington. He succeeds Dr. George Austin who resigned the post to return to full-time teaching and research. Before joining the WSU engineering faculty, Brink was development director for Monsanto Enviro-Chem Systems Inc. in St. Louis, Mo. Brink has the distinction of being the only engineer in Monsanto's history to have a line of products bear his name. Brink instruments, filters and mist eliminators (all air pollution devices) have been installed in 1500 plants worldwide.

During his 19 years with the chemical industry he worked in research, development, engineering, in engineering sales and production supervision, specializing in the development of air pollution control equipment.

Brink was a member of the Purdue University faculty from 1949 to 1954 and received his Ph.D. from Purdue.

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method of looking at the "forest instead of the trees."

The author defines the "instrument" for looking at the large-scale environmental systems, including our industrial civilization, as the "macroscope." This macroscope is clearly a product of our times and in large part attributable to Professor Odum, his brother Dr. Eugene P. Odum, and their associates. It is still evolving; developing largely as a result of our growing awareness of systems in the environment. This viewpoint has been stimulated also by our ability to view situations and conditions from afar and to synthesize large amounts of data, as in weather photography from satellites and in world-wide macroeconomic statistical summaries.

The esssence of the macroscopic technique is a survey of the environment to identify and classify its major components and their interrelationships. These major units are then linked together in a network diagram simulating a simplified circuit. This circuitry provides a model which can be manipulated experimentally to test its validity and to learn the effects of changes in any of the components. The ultimate configuration of the model usually is a network of symbols representing the major components (e.g., the sources of energy and units of photosynthesis, energy-storage, and self-maintenance consumers) connected by lines which show the direction of energy flow between the components. Switches and gates are placed in the lines to indicate the controlling actions (e.g., thresholds at which energy flow is shut off or turned on and actions which have gain, retarding, or multiplying effects) on the energy flow in the circuitry.

An analogy with another method of visualization of complex conditions may be proper here. Patterns of water flow can be shown clearly by use of a free-flow table on which barriers are placed to disrupt the water flow. No amount of equations can adequately explain the resulting patterns, especially to a non-mathematician, but persons of different training can view and mutually discuss their interpretations of the flow patterns. Similarly, this is what Odum's energy diagrams perform, a clear demonstration of major relationships among component parts of large environmental-societal systems which can be understood and discussed by a wide audience.

It is apparent too, that the macroscopic systems approach is nurtured best in an interdisciplinary setting of high order. The problem at the present time is the lack of numbers of people who are trained or experienced in the development of the energy diagrams; one of the objectives of the book is to obviate this situation.

The author shows how power, i.e., the rate of flow of useful energy, is an integral part of all natural systems and pervades all facets of man's activities and, hopefully, could lead to a new morality. In doing this he deals with a diversity of subjects including history, industrialization, economics, and religion. The concluding chapter focuses upon the alternatives of energy supplies in the future: of power expanding, constant, and receding. The author believes that whichever contingency does obtain, mankind will be better equipped to deal with it if he has developed beforehand a morality which blends the best of religion and science.

This book should be studied by all architects, engineers, planners, and decision-makers (especially those making decisions regarding legislation, land use development, and zoning). They will find that Odum's energy system approach provides a tool that, when fully and knowingly applied, will be most useful in developing environmentally-compatible projects. Anyone preparing or reviewing the generally bulky environmental assessments, reports, and impact statements so essential to Federal compliance with the National Environmental Policy Act of 1969, should be greatly interested in energy diagrams as a means of summarizing environmental interrelationships.[1]

The series of papers prior to and succeeding this book give evidence to the evolution and relevance of the macroscopic approach. In the two years since publication, except for the excellent application of its tenets by Dr. Odum and his associates, signs of use of the macroscopic approach are few. Understanding of these recent papers (examples below[1-4]) is predicated largely on the reader's knowledge of the methodology and symbolism developed in the book.

There is little doubt, however, that the macroscopic approach will gain additional adherents and increasing use. So, with Professor Odum, I enjoin you to learn how to use the macroscope and apply it in the search for a better understanding of the large-scale interrelationships among living things and the environment; being mindful that societal objectives are a critical driving force in the environment and must be incorporated into the macroscopic analysis in most cases. □

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