

## Book reviews

### **Practical Handbook of Material Flow Analysis**

Paul H. Brunner, Helmut Rechberger; Lewis Publishers, Boca Raton, FL, 2003, 332 pages, US\$ 119.95, ISBN 1-5667-0604-1

Upon reading the title of this book, one would not expect it would be of interest to environmental engineers. That is a mistake as the authors outline how resources can be conserved and the environment protected with complex systems.

Perhaps the best way to start the review is to quote from the authors' answer to the question "What is MFA?" They write:

"Material Flow Analysis (MFA) is a systematic assessment of the flows and stocks of materials within a system defined in space and time. It connects the sources, the pathways, and the intermediate and final sinks of a material. Because of the law of the conservation of matter, the results of an MFA can be controlled by a simple material balance comparing all inputs, stocks, and outputs of a process. It is this distinct characteristic of MFA that makes the method attractive as a decision-support tool in resource management, waste management, and environmental management."

"An MFA delivers a complete and consistent set of information about all flows and stocks of a particular material within a system. Through balancing inputs and outputs, the flows of wastes and environmental loadings become visible, and their sources can be identified. The depletion or accumulation of material stocks is identified early enough either to take countermeasures or to promote further buildup and future utilization. Moreover, minor changes that are too small to be measured in short time scales but that could slowly lead to long-term damage also become evident."

In defining the purpose of the book, the authors go on to say: "The methods presented will enable the reader to design processes and systems that facilitate careful resource management. The term resources in this context stands for materials, energy, the environment, and wastes. Emphasis is placed on the linkage between sources, pathways, and sinks of materials, always observing the law of conservation of matter. This book is a practical handbook directed toward the practitioner. Hence, many case studies, examples, and problems are included."

This concept and methods proposed by the authors are detailed in a very long Chapter 2 entitled, "Methodology of

MFA". Discussed are analytical procedures, data uncertainties, and MFA software (such as Microsoft Excel, Quickstart with Umberto, and GaBi).

MFA, it is noted, appears to be easy if these steps are followed: define the system, collect the data, calculate the results, and draw conclusions. "In practice, one starts not with the result, but quite often with a poorly defined, highly complex problem that first must be simplified and structured. After the goals of an MFA have been clearly defined, the real art consists of skillfully designing a system of boundaries, processes, flows, and stocks that facilitate solution of a given problem at the least cost."

Presented in Chapter 3 are 14 case studies demonstrating the use of MFA in the fields of environmental management, resource management, and waste management. The first two case studies involve regional lead pollution and regional phosphorous management. These are topics of real environmental concern. These examples are followed by studies of nutrient pollution in large watersheds and a study of the use of MFA for environmental impact assessment.

Other case studies include: (1) resource conservation: nutrient management, copper management, construction wastes management, and plastic wastes management; (2) waste management: use of MFA for waste analysis, MFA to support decisions in waste management; and (3) regional materials management.

Problems for student assignment are found throughout the book.

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### **Ignition Handbook**

Vytenis Babrauskas; Fire Science Publishers, Issaquah, WA 98027, 2003, 1124 pages (8.5 in. × 11 in., format), ISBN: 0-9728111-3-3, US\$ 198.00

Subtitled "Principles and applications to fire safety engineering, fire investigation, risk management and forensic science," the author's goal in writing this book was to "... attempt to cover the entire subject of ignition of unwanted fire." In the forward, a colleague writes, "This book is written for a broad audience, ranging from beginners who are new to the scientific study of ignition to experts who have a well-developed scientific background. The author presents fundamental science relating to combustion,

which is presented in a manner suitable for beginners with only a rudimentary understanding of chemistry, then expands upon this treatment at a level that would be suitable for most advanced experts in areas relating to ignition of fires and explosions. For each topic covered, this book thoroughly presents the relevant underlying science, then uses this science to explore the strengths and weaknesses of typical applications such as regulatory requirements and test methods.”

The author notes that the “. . . handbook contains much material dealing with theory or mathematical aspects of fire.” Though “. . . of importance to fire science and fire engineering specialists. . .,” they “. . . will not be of main interest to fire investigators.” Thus, Babrauskas organized the book so that “. . . schooling in mathematics or science is not necessary in order to obtain practical guidance.” Moreover, the mathematical analyses are not exhaustive with references to the source of the derivations being given for those who want to delve more deeply into the topic.

The book has 15 extensive, well-written and well-documented chapters whose titles are: (1) Introduction, (2) Terminology, (3) Fundamentals of Combustion, (4) Ignition of Gases and Vapors, (5) Ignition of Dust Clouds, (6) Ignition of Liquids, (7) Ignition of Common Solids, (8) Ignition of Elements, (9) Self-heating, (10) Explosives, Pyrotechnics and Reactive Substances, (11) Characteristics of External Ignition Sources, (12) Preventive Measures, (13) Special Topics, (14) Information on Specific Materials and Devices, and (15) Tables.

A comprehensive review of such a mammoth book is not possible. Moreover, this reviewer is not an expert in the fire science area. But, I am an author and can evaluate the writing and effort that went into writing this book. That task was impressive in scope.

Examine these statistics: 1124 pages, 8.5 in. × 11 in. in size, almost 500 tables, over 600 figures, and approximately 5000 references, all of which appear to have been cited in the text.

I do not recall having seen (in recent years) a book of such magnitude.

At the very least, the book is comprehensive.

Additionally, the book is accompanied by a CD entitled “Ignition Handbook Data Base.” Included are five Quatro-pro spread sheets containing data on chemicals, solids, dusts, etc.

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### **Phytoremediation: Transformation and Control of Contaminants**

Steven C. McCutcheon and Jerald L. Schnoor (Eds.); Wiley/Interscience, Hoboken, NJ, 2003, 1015 pages, ISBN: 0-471-39435-1, US\$ 115.00

In the initial chapter, McCutcheon and Schnoor write:

“Phytoremediation is evolving into a cost-effective means of managing wastes, especially excess petroleum hydrocarbons, polycyclic aromatic hydrocarbons, explosives, organic matter, and nutrients. Applications are being tested for cleaning up contaminated soil, water, and air. A number of important botanical processes have been discovered, including phytoextraction and hyperaccumulation from soil, plant-assisted microbial degradation of hydrocarbons in soil, use of specific enzymatic processes involved in created wetland treatment, and several other means of transforming and sequestering organic pollutants. Plant metabolism using sunlight energy and atmospheric carbon dioxide to produce organic matter is fundamentally different from heterotrophic microbial respiration requiring energy, carbon, and nutrients from soil or water. As a result, green plant transformation, conjugation, and sequestration are vital new tools in waste management that are categorized along with methods of vegetative control of pollutants to manage contaminated groundwater plumes and soil.”

And, indeed, it has, as it “. . . involves the use of vascular plants, algae, and fungi either to remove and control wastes or to spur waste breakdown by microorganisms in the rhizosphere.”

As editor of the Journal of Hazardous Materials, I began to receive papers on phytoremediation just in the last few years. It has become a very popular topic. While reviewing this book, I used the search word “phytoremediation” on Science Direct for the 1994–2003 period. The search engine showed 620 citations for phytoremediation. This large number is an indication of the increasing popularity of the technique.

Returning to the editors’ own view of the book’s coverage, I quote from the preface:

“This book covers phytotransformation, phytodegradation, rhizosphere degradation, and phytocontainment of xenobiotic organic pollutants and select inorganic compounds that plant enzymatic processes transform or mineralize.”

They continue later in the preface to say:

“To broadly cover the latest advances from fundamental investigation to field testing of concepts, seven sections are the basis for organization for this book hytoremediation. Each section starts with fundamental contributions that define the state-of-the-science and ends with chapters on the applications of fundamental and heuristic concepts in practical settings.”

It is noted that all chapters (even the initial chapter by the editors) were peer reviewed. The 80 plus contributors are broadly drawn from universities, government agencies (USGS, USEPA, US Army Corps of Engineers, USDA, etc.), consulting firms, and foreign laboratories (Japan, Germany, Denmark, Italy, Switzerland and Czech Republic).