

preparatory test such as the author's own *Third Dimension in Chemistry* or Arthur Loeb's *Space Structures: Their Harmony and Counterpoint* (see PHYSICS TODAY February 1977, page 56). The profuse illustrations, many of them stereographic pairs, are frequently fascinating, but in some cases are inadequate or obscurely complex. Wells lists relevant crystal structures in a separate index, but there is a lamentable absence of any overall tabulation of the networks and their geometric parameters. In short, this is a brilliant book, but not an easy one from which to extract information.

In contrast, Peter Pearce in his *Structure in Nature is a Strategy for Design* makes every effort to make perusal of his book easy for the inexperienced reader. This is in keeping with his aim of presenting to the general public his theories on structural design. Pearce's approach emphasizes the use of geodesic surfaces, usually single or multiple saddles, whose joints lie parallel to cubic symmetry axes. Pearce has already demonstrated his concepts through the toys and playground structures manufactured by Synestructics Inc.; his book is directed toward their application in architecture. Like Wells, however, Pearce devotes most of the book to the derivation and description of hitherto unpublished geometric structures.

The book opens with introductory chapters on physical and biological structures in nature, structural rigidity, symmetry, and on known geometric structures such as planar tilings, polyhedra packings and networks. In the second section, Pearce demonstrates that periodic network circuits define the boundaries of geodesic saddle surfaces and therefore correspond to packings of curved-face polyhedra. He then describes and tabulates the properties of 53 saddle-faced polyhedra, 42 corresponding

space-filling packings and 14 curved-surface "labyrinths" (three-dimensional polyhedra in Wells's terminology). The third section examines some useful geometric properties of these structures, such as triangulation of continuous-curved surfaces, open polyhedra packings, and the generation of finite polyhedral clusters with potential internal diversity. The fourth section discusses architectural applications.

The book is easy to read and offers many plausible and original geometric ideas. It is lavishly illustrated and contains many useful tables listing the structures and their geometric parameters. Its chief shortcoming, from a physicist's viewpoint, is the lack of mathematical content. Pearce gives no topological derivations (Euler's rule is confined to a footnote) and ignores the symmetry properties of the structures (for example, their definitions in space-group notation).

The relevance of these books to crystallography and architecture is fairly obvious; their value for physicists in other fields largely remains to be demonstrated. The relation of the labyrinth structures to heat exchangers and honeycomb fabrication is immediately apparent. Some of the networks bear enough resemblance to Michell's optimum strength/weight frameworks to recommend them for consideration in aerospace and solar-array extended-structure applications. Integrated-circuit architects may well find inspiration in some of the high-connectivity nets. In summary, few physicists will feel obliged to study these books in detail, but many will find a brief examination stimulating and rewarding.

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Nuclear Power Reactor Safety

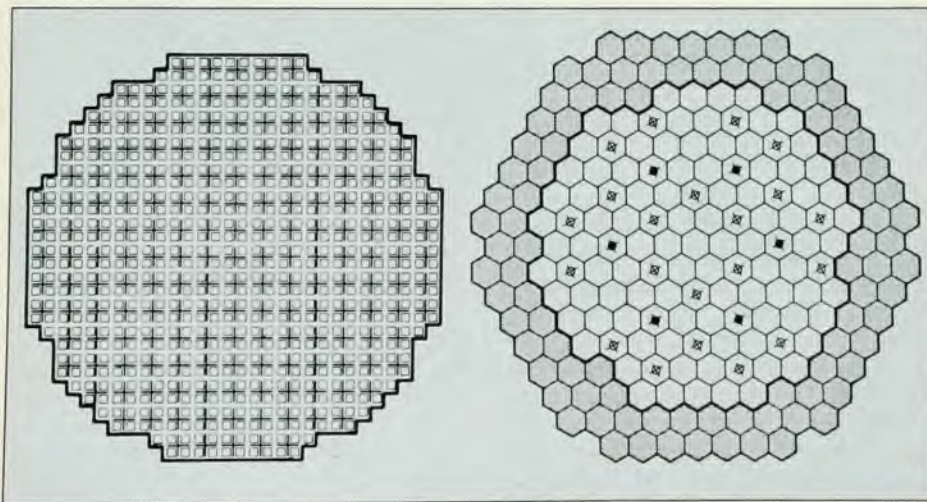
E. E. Lewis

630 pp. Wiley-Interscience, New York, 1977. \$32.00

Nuclear reactor safety is a highly politicized subject, on which passions run high, so that it is a pleasure to see a book that simply contains an enormous amount of technical information about the behavior of reactors in upset conditions, and grinds no visible axes. *Nuclear Power Reactor Safety*, by Elmer Eugene Lewis of Northwestern University (no relationship to the reviewer), is just what the title implies. It is a book that leads the reader through a rather detailed quantitative discussion of the design and operation of reactors, through a treatment of the role of quantitative risk assessment, reliability and such things, to a detailed assessment of the various mishaps that can befall a reactor. The latter include transients, fuel element failures and loss-of-coolant accidents. Finally there is a long discussion of containment, and of the consequences of an accident. The book is complete and informative on the subject of technical reactor safety, and is even sound on the more elusive subjects, such as licensing, redundancy, and reliability.

One subject not covered at all in the book, perhaps through a wise choice on the part of the author, is probabilistic safety analysis—the effort to quantify the probability of malfunction of a reactor. The Reactor Safety Study issued by the Nuclear Regulatory Commission in 1975 was a major effort to do just that, and Lewis extensively uses it and its draft version as references in the book. He uses it, however, only as a source of technical information on reactors, rather than for its major content, the calculation of the probability of a core melt. While the results of that calculation in the Reactor Safety Study leave something to be desired, the methodology involved—the quantitative evaluation of the probability of different upset sequences in a reactor—can become a very powerful tool for the rationalization of nuclear safety assessment. The Nuclear Regulatory Commission has only recently issued a policy statement committing itself and its staff to wider application of these procedures in the regulation of the nuclear industry.

This is only a small cavil, because a proper treatment of probabilistic risk assessment would entail a separate book by itself, and its omission does not detract in any way from the usefulness of this book. It is clearly the place of choice to



Control rods are used in nuclear power reactor cores to compensate for fuel depletion and temperature effects as well as to execute changes in power level and to shut down the reactor. Because the control rod is effective over only a short distance, a substantial number of them must be distributed uniformly through the core. Shown above are control-rod arrays for a boiling-water reactor (left) and a gas-cooled fast breeder (right). (From E. E. Lewis's book reviewed here)



North-Holland ANNOUNCES:

Nuclear Physics with Heavy Ions and Mesons

Proceedings of the Les Houches Summer School Session XXX 4 July - 20 August, 1977

edited by R. BALIAN, M. RHO and G. RIPKA.

1978 Volume I: xxx + 432 pages
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This session of the Les Houches Summer School studies both these fields in parallel. A union was achieved of the different concepts and methods currently used in heavy-ion and intermediate energy physics in order to avoid an unnecessary split due to excessive specialization.

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matter (Hans J. Pirner). Seminar 7: Chiral Symmetry and neutral pion condensation (François Dautry). Course 10: Symmetries and nuclei (Sir Denys Wilkinson).

Gauge Theories and Neutrino Physics

edited by M. JACOB.

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The study of neutrino-induced reactions is a highly topical domain in particle physics: extensive neutrino programs are presently underway at all high energy proton machines. Neutrinos have long been known as very interesting probes for the study of hadron structure. High intensity beams and extensive detectors may compensate for the smallness of the relevant cross-sections, and the study of neutrino-induced reactions provides most valuable clues.

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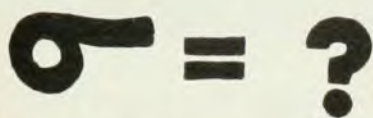
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Industrial Applications of Lasers

J. F. Ready
588 pp. Academic, New York, 1978.
\$28.50

This book, a survey of the present use of and future possibilities for lasers in industry, is intended for people contemplating the use of lasers in an industrial application. As such, it is a technical report on the status and direction of laser applications in the late 1970's. The book was written by John F. Ready, a scientist at the Honeywell Corporate Research Center, and author of an earlier laser monograph, *Effects of High Power Laser Radiation* (Academic, 1971). The comprehensive survey touches nearly every application that has any industrial potential.

After a necessarily brief review of lasers and their properties, Ready discusses their care and maintenance. I know of no other single repository of useful information on damage and deterioration in lasers and on the care and maintenance of the devices. This chapter is well done. In the succeeding chapter on laser safety Ready takes a common-sense attitude that is needed in these days of intimidating light shows and draconian laser-safety rulings. Chapters on laser measurement are informative and relatively comprehensive because a good deal of the basic research and development has been done. The same comments apply to the chapters on material processing, which is Ready's forte. The sections on holography and information-related applications suffer by comparison. While Ready asserts the importance of optical-fiber communications, he does little to give the reader a feel for the limitations and difficulties, and the important parameters of current systems. Ready is not at fault, because an enormous acceleration in development in this field occurred during the book's production.

The text also contains a short chapter on recent work on chemical applications of lasers. Ready's statement on Raman spectroscopy is somewhat misleading in that he asserts that the "variety of laser wavelengths makes it possible to carry out Raman Spectroscopy while avoiding interfering absorption bands. With a tunable laser, the excitation frequency can be tuned to produce a larger Raman signal." In fact, it is excitation into those absorption bands that produces the enhancement. It is fluorescing bands that can

(sometimes) be avoided by a judicious choice of laser wavelength.

While Ready intended "to make the book reasonably self-contained," he did not extend this concept to the various chapters by including back references to concepts explained earlier in the text. Therefore, a reader may not be able to dip into a particular chapter of interest without a good deal of thumbing through the index and the earlier chapters of the book. In some cases, however, even this strategy cannot guarantee success. Ready mentions a retroreflector in chapter 8 without explanation but describes it in chapter 10 (and later in the chapter explains it again in a footnote). Certain passages, particularly those on semiconductor lasers, are repetitious, and other passages mention without explanation a number of uncommon concepts (getters, dithering servo, spatial filtering, flatpacks and ECM machines, for example).

This book is appropriate for those outside a particular field of laser application who want to gain an elementary understanding of that field. As such, it will be a useful addition to industrial and university libraries. The text is not, however, useful for a designer of laser systems to consult for answers. It is a detailed report card on the 18-year-old laser as it comes of age. John Ready's book gives the laser impressive marks.

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Beyond the Moon

P. Maffei
377 pp. MIT, Cambridge, 1978 (first Italian edition, 1973). \$12.50

Paolo Maffei tells us that his new book *Beyond the Moon* is the story of a voyage through space. He means to show us the wonders of the universe by starting from the Moon (where we have already voyaged via Apollo) and visiting in turn each planet, the stars, star clusters, galaxies, clusters of galaxies, and the universe itself as a cosmological whole. While he claims that the book is not quite a textbook of astronomy, it is hard to see it as anything else. In reality, it is little more than a catalog of astronomical facts, laid out in the usual format of introductory textbooks, but lacking the elegance that characterizes many of the other texts that have appeared in recent years.

If the reader should casually page through the book, he will find, for example, that Mercury has a weak magnetic field (0.0037–0.0070 gauss); Venera 9 and Venera 10 landed 2200 km apart; the light curve of β Lyrae eclipses every 12 days, 22 hours, 22 minutes; Mira Ceti is 163 light-years from us; and by June 1970, 1603