Everything e⁻ can do ν can do better

P.W. Hawkes

Optical Information Processing: Fundamentals. Edited by S.H. Lee. Pp.308. ISBN 3-540-10522-0. (Springer-Verlag: 1981.) DM 99, $42.20.

How is optical information processing getting on? For nearly two decades now, the advantages of light for manipulating data have been attracting more and more attention, although, as Casasent says in this book, "optical processors are somewhat like discrete transistors before the dawn of LSI; they are truly in their infancy". These advantages may be summarized as parallel processing, high throughput and the ability to perform such operations as cross-correlation virtually instantaneously. Such features clearly make optical processors serious potential competitors of digital systems, though, to quote Casasent again, "the shortcomings of one system are the advantages of the other. The two technologies (optical and digital) are actually complementary rather than similar".

The present text, which should be regarded as a companion to an earlier volume in the same Springer series edited by Casasent (*Optical Data Processing: Applications*, 1978), gives an impressively complete account of the degree of sophistication that such optical systems have reached. About a third of the book has been written by the editor, S.H. Lee, who first sets out the basic principles, covering essentially the Fourier transforming properties of lenses and their mathematical implications. His chapter on coherent optical processing then gives an account of filter design and synthesis, including optical feedback, and classifies the various thick and thin filters; a number of more elaborate processor designs are described and clearly illustrated, and the chapter ends with a few words on coherent noise suppression.

The third chapter, by W.T. Rhodes and A.A. Sawchuk, deals with incoherent optical processing, where the advantages of easy input/output, tolerance towards dust and other common imperfections of laboratory equipment and the absence of phase problems is offset by the restriction to real, non-negative signals. This is followed by an extremely important contribution by G.R. Knight on interface devices and memory materials. If the progress described here is maintained, optical processors cannot fail to gain in importance even though an immense amount remains to be done. Some of the problems of purely optical processors can be circumvented by using hybrid systems, as D. Casasent explains in the next chapter. Here, the most powerful features of optical and digital systems are united so that the fast two-dimensional signal handling of the optical unit complements the flexibility of the digital computer. More space might have been given to the achievements of Lohmann's school in Erlangen, which has made many interesting contributions in this field.

The penultimate chapter, by J.W. Goodman, deals with a difficult task on which comparatively little work has been done, linear space-variant optical data processing. Crudely speaking, here we are concerned with integrals that are not in the form of convolutions and hence do not separate conveniently under Fourier transformation. Goodman's clear statement of the problems involved is particularly welcome. The book concludes with a further contribution by the editor, on nonlinear optical processing: "logarithm, exponentiation, intensity level slicing, thresholding, analog-to-digital conversion, logics and bistability", the last four of which are "important toward developing a futuristic digital optical processor".

Applications of these various techniques are only mentioned in passing, as we should expect in a book on "fundamentals", but many are explored in detail in Casasent's earlier volume which contains chapters on optical transforms and systems, enhancement and restoration, synthetic aperture radar (one of the first triumphs of optical processing), photogrammetry, nondestructive testing and metrology, biomedical applications and signal processing. Taken together, the two books give an excellent account of the present state of this field, still young but rapidly maturing. A minor criticism is the under-representation of European work in both works — perhaps this can be rectified in a future volume in the series. Even so, they give the best available account of a mass of new material, written by experts on the various topics. □

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Myriapod carnivores

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The Biology of Centipedes. By J.G.E. Lewis. Pp.476. ISBN 0-521-23413-1. (Cambridge University Press: 1981.) £33, $69.95.

Few students of the soil fauna can fail to be fascinated by centipedes, although these elusive predators are often overlooked because of their secretive habits. Accounts of their biology have hitherto been widely scattered in the literature, usually in a fragmentary fashion. There has long been a need to gather this information together, stemming from the recognition that these carnivores may regulate the prey populations on which they feed. The prey (mainly Collembola) are principally primary consumers of dead organic material, and predation by centipedes on these "key industry" detritivores may operate to control, indirectly, rates of organic decomposition.

In this book, Dr Lewis does not concern himself with this latter theme to any great extent; indeed, by his own admission, his ecological survey is less than comprehensive. In this, however, he is a victim of circumstances since the integration of centipede ecology with that of the entire soil–litter system is only just beginning. What he has provided is a comprehensive account of centipede biology which soil ecologists will find most useful, and which forms a worthy complement to Eason's earlier taxonomic treatise, *Centipedes of the British Isles* (Warne, 1964). Eason, however, dealt only with British centipedes, and Dr Lewis's experience with temperate and tropical myriapods is reflected in a widely based survey of centipede anatomy, behaviour, physiology, reproduction, life histories, taxonomy and ecology. He devotes as much attention to the mainly tropical Scolopendromorpha as he does to the temperate Lithobiomorpha and the cosmopolitan Geophilomorpha.

As the dust cover of the monograph reminds us, this is primarily a source-book and the way in which Dr Lewis organizes his information — into sections dealing with taxonomic groups — emphasizes the point. Although this device allows the reader easy access to the subject matter, since it is repeated chapter after chapter, the result makes for less than compelling reading; this is a book to inform rather than to be contemplated at leisure. The style is direct, as befits a rather clinical presentation of a catalogue of facts, and the illustrations are numerous but variable in quality, which may reflect the fact that they were taken directly from original sources rather than re-drawn. The reproduction of Manton's (1965) figures are, for example, excellent as might be expected. At the other extreme, the figure of *Lithobius forficatus* eating a fly (Fig. 126) is less than impressive and perhaps unnecessary. Some figures are inadequately labelled (for example, Figs 162a, 203b, 204 and 206). The bibliography is extensive and up to date, and although there is no author index a detailed subject index is provided.

My overall verdict is that the author has succeeded admirably in what he has set out to do. Despite its defects, many of which are unavoidable, the result is a valuable reference book which will be sought by undergraduates and research workers alike. □

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