Semiconductors from Bell Laboratories

Andrew Holmes-Siedle

Physics of Semiconductor Devices, 2nd Edn. By S.M. Sze. Pp.868. Hbk ISBN 0-471-05661-8; pbk ISBN 0-471-05983-7. (Wiley: 1982.) Hbk £37.20, $63.20; pbk £12.91, $23.30.

THE impending publication of a new edition of a famous textbook is always an occasion for keen anticipation. In the field of semiconductor devices, there have been few textbooks more authoritative or comprehensive than the first edition of *Physics of Semiconductor Devices*, a book which bore the stamp of the author's broad personal experience of device development and the unique aura of Bell Laboratories. That 1969 edition, however, was clearly becoming dated by the rapid advance of integrated semiconductor device technology. The performance and sizes of devices had altered by orders of magnitude, while the principles of device operation had been the subject of over 40,000 research papers. Obviously, the revision of so comprehensive a book would be a huge undertaking.

I can only say that the task has been completed with a thoroughness that leaves me open-mouthed with admiration. All the parts of the first edition which I had earmarked as obsolete have been eradicated, and the structure has been subtly altered to accommodate the changes of the past 15 years. Dr Sze states that over 65 per cent of the references and diagrams are new and 80 per cent of the text has been revised. All this has been done most effectively; the mark of authority again appears in the large amount of new material added.

The first edition was divided into five major sections: Physics; p–n Junction Devices; Interface Devices; Optoelectronic Devices; and Bulk-Effect Devices. In the second edition, the major growth of metal-oxide–semiconductor device technology has been acknowledged by means of a new division of sections betwen bipolar and unipolar devices. Microwave devices also have their own section, while photodetectors and solar cells are now rightly given chapters to themselves. The broadening of the treatment of solar cells will prove extremely useful to many students of energy generation: it goes so far as to give some useful data on geographical distribution of solar flux and its spectral properties, relates these to mechanisms of conversion in semiconductors and adds a fascinating account of the new device structures being investigated (for example the textured single-crystal surface, the cascade two-junction cell, thin films etc.).

In the section on metal-oxide–semiconductor devices, the author evidently felt that there was a danger that the immense body of recent information could run away with the book; for instance, there is a notable austerity in the handling of MOS measurement methods. In the section on the myriad forms of the MOS field-effect transistor (the device which has revolutionized computers, watches, entertainment and communications), the new relevance of the submicron device structure is well described. Surprisingly, the author manages to confine the growth of these sections to an increase of about ten pages. At the same time little that is really important has been left out, although (inevitably) details of processing and circuitry have had to be ignored. Real flaws are rare. The brief treatment of ionizing-radiation effects is not up-to-date; so much has happened since the 1967 references given. Also, it is probably wrong to say that carrier generation in SiO_2 is caused "by breaking Si – O bonds".

While such a concentrated treatment of semiconductors could never be light reading, Dr Sze has certainly taken pains to present his material clearly, with liberal use of line drawings as explanations in their own right. As a result, the book will remain an indispensable companion to the student and research worker. Moreover, I believe it will be illuminating for journalists and others who have to know what this commercially-important field of semiconductors is about. □

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●Volume 3 of *Electron Microscopy of Proteins,* edited by James Harris, has recently been published by Academic Press. Price is £27.80, $57. For review of Vols 1 and 2 see *Nature* **298**, 498; 1982.

Fingers on the pulse of the insect

John Brady

Insect Clocks, 2nd Edn. By D.S. Saunders. Pp.409. Hbk ISBN 0-08-028848-0; pbk ISBN 0-08-028847-2. (Pergamon: 1982.) Hbk £45, $90; pbk £24, $48.

FEW scientific monographs survive to a second edition, and still fewer get there within six years of the first. It is a measure of the success of *Insect Clocks* as a textbook, and of the general interest in this apparently esoteric corner of biology, that the book has already been given a face-lift.

The interest in insect timekeeping stems from insects' economic importance and the tantalizing hope of distressing their life cycles in our favour by manipulating their clocks. It must be said, however, that basic knowledge of their timekeeping — as evinced by the 1,120 papers Saunders reviews — far outstrips any practical manipulation thereof. This is in marked contrast with the commercial application of false photoperiods to induce plants to flower or poultry to ovulate year in and year out. The unfortunate truth is that 99 per cent of insect pests occur in the open air.

If justification for this second edition were needed it is that since 1976 a number of gaps in our knowledge have been closed. An important one is the apparent reconciliation of "hour-glass" and "circadian" explanations of insect photoperiodic control. The former finds daylength apparently being measured by a single, non-repeated process (like a kitchen timer), the latter that organisms seem sensitive to light at a particular point in their daily cycle, every day (like a 24-hour light-sensitive clock).

One should never expect simple answers in biology, however, and having argued the reconciliation in depth, Saunders is then forced to largely demolish his case with an added footnote saying that A.D. Lees's latest evidence from his aphids can still best be described as an "hourglass".

That much less is known of the ultimate chemistry and physiology of insect clocks than of those of micro-organisms or molluscs is as apparent in this second edition as it was in the first. Most research over the past six years has been along the same lines as before, dealing with phenomenology and modelling of insect timekeeping, and it is with this that the book's 400 new references are chiefly concerned. Nevertheless the — albeit modest — advances in knowledge of the clock's coupling mechanisms do seem underplayed. The greatest single addition to the book is a long new chapter on multioscillators.

All is admirably explained in Saunders's usual lucid style, and this time he has removed some of the unnecessary algebraic symbols that speckled the first edition. The book does still suffer slightly from its original division into chapters on rhythms in single insects, rhythms in populations and rhythms in physiology, with the result that entrainment, phase response curves and so on have to be dealt with repetitively rather than as the single phenomena they are. *Insect Clocks* is, however, well on the way to becoming a classic, and this new edition should surely find its way onto the shelves of insect physiologists and chronobiologists alike. □

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