BOOK REVIEWS

CHILLINGWORTH, D. R. J., *Differential Topology with a view to applications* (Pitman, 1976), £8·50.

The work in the last decade by Smale and many others on dynamical systems would interest many people who work with differential equations. Such results are attractively discussed in the last (fourth) chapter of this book, and there is an extensive and useful bibliography. A mathematics graduate from most British Universities would not be sufficiently au fait with differentiable manifolds to understand the language, but the book is sensible to this need in Chapter 3.

However the stated aim of the book is to make this material accessible to someone with a background of engineering mathematics only. Here the book fails, in my opinion. One could well imagine that the lecture course from which it developed was an excellent one, but in the written account the balance between essential and incidental suffers and the level of sophistication presupposed fluctuates widely. In the first two chapters on analytic topology and calculus the treatment is not crisp enough, examples are few, more terminology is introduced than is needed and it would be difficult to absorb it all, and the choice of proofs included and of topics is debatable. Does a research engineer need to worry about both Weierstrass and Heine–Borel on page 28, and should he find out what a ring and an algebra are on page 81, or not? A more geometric approach would appear to have been preferable. The whole book suffers somewhat, and the early chapters very much so, from new sections not being adequately motivated in advance, and more signposts would have been helpful.

Despite the shortcomings of the book for a mathematically unsophisticated reader, many mathematicians should find (the latter part of) the book a useful exposition of a most interesting subject.

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POSTON, T. and STEWART, I. N., *Taylor Expansions and Catastrophes* (Pitman, 1976), £5·90.

The mathematical ideas surrounding Thom's theorem on the classification of catastrophes have hitherto been available at two extreme levels — popular accounts or detailed treatments. This book fills the intermediate need and can be recommended. It requires from the reader only a basic knowledge of the calculus of several variables and a willingness to think geometrically, and clearly explains and makes plausible the concepts and results rather than prove them. Examples are worked through, definitions are kept to an absolute minimum, and the informal style is at best illuminating (e.g. transversality in Chapter 1) and at worst unconvincing, but never misleading.

The first chapter discusses the ideas from differential topology, scattered in the literature, required for the second chapter, which is appropriately titled "Thom's classification theorem — an intuitive approach". The third chapter gives rules for determinacy and unfolding computations, i.e. given a function near the origin by its Taylor expansion deciding how many terms are required so that the resulting polynomial can be changed back into the original function by a smooth change of variables (determinacy), and finding all functions close to a given function up to change of variables (unfolding). These cookbook instructions could be followed by any user who can differentiate a polynomial, but most pure mathematicians will probably prefer to extract the methods for themselves from the theorems in, say, Bröcker's book, where the formulation using ideals and rings has greater clarity. In Chapter 4 the method of Zeeman's description of the classification of two variable cubics under linear changes of variable (in Chapter 2) is nicely extended to quartics. The last chapter gives two physical examples where the previous chapters are applicable.

The book is generally well-written, but more careful proof-reading in the later chapters would have saved this reader annoyance and occasionally effort. A popular article on catastrophe theory should perhaps be read first, otherwise the winks and nods about physical applications would be disturbing, and the discussion about "typicality" long before the statement of Thom's theorem would appear unmotivated.

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