BOOK REVIEWS

ALAN LAW

Interdisciplinary Lively Application Projects (ILAPs), edited by David C. Amey, Published by The Mathematical Association of America, USA, 1997, ISBN# 0-88385-706-5, softcover, 222+ pages.
Reviewed by ***T. W. Leung****, Hong Kong Polytechnic University.*

This book is a collection of eight modelling projects (interdisciplinary lively application projects) developed by academics from a consortium of twelve schools led by the United States Military Academy. It is not a book on modelling theories and techniques [1], nor a collection of many modelling cases [3]. Rather, every project is a step-by-step guide to how a situation arises that requires mathematical modelling, about complications involved when trying to set up a model, and means to solve the model. In spirit, the projects are akin to the UMAP modules.

Mathematics backgrounds employed in these projects are calculus, linear algebra and basic statistics. For instance, in the project "Getting Fit with Mathematics", simple regression analysis is used to compare several variables, whereas in "Parachute Panic", the basic ingredient is a first order ordinary differential equation, while in "Flying with Differential Equation", it is in essence a demonstration of oscillation and resonance. Making use of vector calculus, Stokes's theorem and the like, the project "Contaminant Transport" is mathematically the most sophisticated.

Nevertheless because these projects were produced as "interdisciplinary" efforts, new elements were added. We learn about oxygen consumption, ATP, VO_2 and others in "Getting Fit with Mathematics", and it is interesting to observe so many variables playing a part. In the "Decked Out", only simple algebraic manipulations are used to solve the model, but we also learn about Bill of Materials (BOM). In "Parachute Panic", besides the free fall, we see also "severity index" and the interplay of different forces. A novelty of these projects is that they were produced by cooperative efforts from different disciplines, which makes the projects more realistic, instead of merely exercises in mathematics (for comparison, see the review [4]).

The authors take a "no nonsense" approach, analyze the situation, set up a model using simple mathematics, solve the model, freely using computer packages if necessary. The hard part of each project is the formulation of the model, and the problem of verifications of a model is often unanswered. They demonstrated using mathematics as a "tool", and a tool should be simple to use (user-friendly), and serves few special functions, I believe. Time and again I was told by my colleagues from engineering departments that we should teach mathematics as a tool, and that it may help them to solve problems. This is a point often neglected by mathematicians, and our sense

of importance in mathematics may differ from the engineers or the scientists. Concerning using computer packages, it seems the authors concede that students may not understand the theories involved, and it is OK. A similar view was echoed in [2].

Another point seemingly to be advocated by the authors is that students may learn the necessary mathematics during the modelling process. This is in line with the recent movement of curriculum reform (see p.205, also for example [5]). In these days the students' backgrounds are so weak and varied, perhaps it is better that students take basic courses in calculus and linear algebra first, before entering into this kind of endeavour.

In short it is nice to try these projects in a modelling course, asking students to look for variations and verifications. Therefore this book serves as a good reference for investigation.

References

1. D.E. Edwards and M. Hamson, *Guide to Mathematical Modelling*, Macmillan Education Limited, London, 1989.

2. M.S. Jones, Teaching Mathematical Modelling, Int. J. Math. Edn. in Sci. & Tech., Vol. 28, # 4, July/August, 1997, pp. 553–560.

3. M.S. Klamkin (Editor), *Mathematical Modelling, Classroom Notes in Applied Mathematics*, SIAM, 1987.

4. D. Lawson, Review of *Industrial Mathematics: A Course in Solving Real World Problems*, Bull. IMA, Vol. 31, # 7/8, July/August, 1995, pp. 124–125.

5. D. O'Shea and H. Pollatsek, Do we need prerequisites? Notices of the AMS, Vol. 44, # 5, 1997, pp. 564–570.