REFERENCES

1. K. V. MARDIA (1990) *Families of Bivariate Distributions*. Griffin, London.
2. N. L. JOHNSON and S. KOTZ (1972) *Distributions in Statistics: Continuous Multivariate Distributions*. Wiley, New York.

Emergent Computation
STEPHANIE FORREST (Editor)
MIT Press, London, 1991. 452 pp. £29.25
ISBN 0 262 56057 7

There has been an increasing interest in computational systems where a global behaviour emerges from local interactions among component parts. This 'emergent computation' is the topic of this book. The editor claims that the book comprises a collection of 31 essays but it is more fairly described as a collection of research papers. These were presented at the ninth in a series of annual interdisciplinary conferences on Emergent Computation organized by the Center for Nonlinear Studies at Los Alamos National Laboratory. The papers were originally published by Elsevier Science Publishers as a special edition of *Physica D*, Volume 42. I would have thought that the researcher could have found the papers there but the MIT Press obviously feel that there is a wider market interested in this topic.

Emergent computation arises in diverse areas such as artificial networks, adaptive systems, classifier systems, connectionist learning and biological networks. The OR worker will probably have met, and perhaps used, the technique within genetic algorithms or neural networks. There are several papers in this collection which will be of interest and the book would be a useful addition to an OR library.

There are some interesting papers on genetic algorithms (GAs) including one by Holland, a key figure in GA development. I particularly enjoyed a paper by W. Daniel Hills describing how simulated evolution can be used to find minimal sorting networks. This practical optimization problem illustrated how co-evolving parasites could be used to avoid local maxima. Another interesting paper describes the coupling of the genetic algorithm and neural network paradigms. In the paper by Schaffer *et al.*, the chromosomes in the GA's population represent architectures for feed-forward networks.

Most OR workers will have met simulated annealing, another stochastic search paradigm similar to GA. Both techniques have been applied successfully to a range of OR problems and both exhibit obvious parallelism. Parallel implementation of the techniques is an important research topic which could yield very positive benefits to the OR community. In a paper by Daniel R. Greeling, a comprehensive, taxonomic survey of parallel simulated annealing techniques is given.

It can be argued that parallelism is an inherent feature of emergent computation. In Kanter's paper, the convergence time of parallel dynamics is compared analytically with that of random, sequential dynamics. The results are discussed in the context of neural networks and Monte Carlo simulations.

I have highlighted a few papers that might interest the OR researcher. If you are working with AI techniques, neural networks, genetic algorithms or parallelism, this is definitely a book to get hold of. You are bound to find several papers of interest. However, if you are not actively researching in this field, this book will be of little interest. It is not a suitable introduction to this new and exciting field.

V. J. RAYWARD-SMITH