

SERIES EDITOR'S PREFACE

Approach your problems from the right end and begin with the answers. Then one day, perhaps you will find the final question.

'The Hermit Clad in Crane Feathers' in R. van Gulik's *The Chinese Maze Murders*.

It isn't that they can't see the solution. It is that they can't see the problem.

G.K. Chesterton. *The Scandal of Father Brown* 'The point of a Pin'.

Growing specialization and diversification have brought a host of monographs and textbooks on increasingly specialized topics. However, the "tree" of knowledge of mathematics and related fields does not grow only by putting forth new branches. It also happens, quite often in fact, that branches which were thought to be completely disparate are suddenly seen to be related.

Further, the kind and level of sophistication of mathematics applied in various sciences has changed drastically in recent years: measure theory is used (non-trivially) in regional and theoretical economics; algebraic geometry interacts with physics; the Minkowski lemma, coding theory and the structure of water meet one another in packing and covering theory; quantum fields, crystal defects and mathematical programming profit from homotopy theory; Lie algebras are relevant to filtering; and prediction and electrical engineering can use Stein spaces. And in addition to this there are such new emerging subdisciplines as "experimental mathematics", "CFD", "completely integrable systems", "chaos, synergetics and large-scale order", which are almost impossible to fit into the existing classification schemes. They draw upon widely different sections of mathematics. This programme, *Mathematics and Its Applications*, is devoted to new emerging (sub)disciplines and to such (new) interrelations as *exempla gratia*:

- a central concept which plays an important role in several different mathematical and/or scientific specialized areas;
- new applications of the results and ideas from one area of scientific endeavour into another;
- influences which the results, problems and concepts of one field of enquiry have and have had on the development of another.

The *Mathematics and Its Applications* programme tries to make available a careful selection of books which fit the philosophy outlined above. With such books, which are stimulating rather than definitive, intriguing rather than encyclopaedic, we hope to contribute something towards better communication among the practitioners in diversified fields.

Stochastics is, as a well-developed specialism in mathematics, a relatively young discipline and probably the fastest growing one. It is extraordinarily important in applications. There are, of course, many phenomena in nature and engineering which have a random component. But the applications of stochastic thinking are not limited to such cases. Stochastic models also can be, and are, used to model other phenomena which do not have an obvious random component. For example, very complicated deterministic phenomena (turbulence, chaos) can sometimes fruitfully be handled in this way, or unknown aspects of a given class of models can be incorporated by means of stochastic ideas. Further, there are the interrelations between potential theory and probability and, of course, the evolution equations for the density of suitable continuous-time Markovian processes are partial differential equations, and such equations may well arise in different contexts. And in

such cases a stochastic interpretation can be very fruitful. Quite generally there seems to be a tendency in mathematics as a whole for ideas from stochastics to penetrate into other areas. For example, stopping times are a powerful tool in certain parts of analysis.

As already remarked, stochastics has very many 'applications': in physics, in chemistry, in geology, in astronomy, in all kinds of engineering, These application areas have all evolved their own corresponding intuitions. In this book, the ways physicists think about these things and the way engineers do are brought together. That was the idea of the meeting on which it is based. There is more on this theme in the preface to the book. And it is clear from the meeting itself that such an interaction can be remarkably useful and stimulating. This book will help to further enhance this beneficial interaction.

The unreasonable effectiveness of mathematics in science ...

Eugene Wigner

Well, if you know of a better 'ole, go to it.

Bruce Bairnsfather

What is now proved was once only imagined.

William Blake

Bussum, September 1987

As long as algebra and geometry proceeded along separate paths, their advance was slow and their applications limited.

But when these sciences joined company they drew from each other fresh vitality and thenceforward marched on at a rapid pace towards perfection.

Joseph Louis Lagrange.

Michiel Hazewinkel