BOOK REVIEWS

Two Stochastic Processes, by John A. Beekman. Published by Almqvist & Wiksell, Stockholm.

Professor Beekman is an expert in at least two areas of applied mathematics, namely risk theory and quantum mechanics. The prototype of stochastic model in risk theory is the Compound Poisson process, the basic tool in quantum mechanics is the Gaussian process. It is the merit of this newly published book to expound these two basic processes, to show their applications in the above-mentioned areas and to indicate the connection between them.

The book starts with a chapter explaining the notion of a stochastic process by intuitive appeal to some examples (two of them chosen from physics, one from control theory). The second chapter introduces the necessary elements of integration theory. Beekman chooses to build his mathematical edifice on the notion of the classical Stieltjes integral. Later on (in chapter four) he has to switch to the more advanced integration concept as developped by Lebesgue and Wiener. I wonder why the classical Stieltjes definition is still so popular among text book writers since e.g. it does not permit to compute for all arguments the convolution of a discontinuous distribution function with itself.

Chapter three — The Collective Risk Stochastic Process, is introduced by the kind remark that there are at least three good reasons for studying this subject (1) to learn about a valuable tool for insurance management; (2) to enjoy the intellectual beauty of the subject; and (3) to learn of its mathematical methods in order to apply them outside of insurance. Beekman does extremely well in summarizing such a wide subject on 49 pages. He achieves also a remarkably closed presentation by essentially concentrating on two elements: the distribution of accumulated claims and the probability of ruin. For both topics he gives rigorous definitions, exact results and approximations.

Laplace and/or Fourier transforms are used in the usual manner. I do miss the NP method (see Beard—Pentikäinen—Pesonen) among the approximation techniques. Everybody known to me who has worked with it has been surprised by its unexpectedly good accuracy.

Researchers in risk theory are grateful to Beekman for his explaining and interpretating of results in the area of Gaussian Markov Processes. As these processes have continuous sample functions some of the problems have solutions which are easier to obtain than in the compound Poisson case. In particular the distribution of the maximum can be explicitly calculated both in the case of a Wiener process without and even with drift. A list of 16 useful distributions illustrates this point.

How little interreaction there has been so far among researchers in quantum mechanics (interested in Gaussian processes) and risk theory (interested in compound Poisson processes) is evidently documented by the few pages of chapter five—Connection between the Two Processes. Actually it seems to me that the papers of Gerber and Jackson should rather

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be classified under the heading of application of Gaussian processes to insurance problems as well whereas only the ideas originating from Iglehart, Gluckman and Bohman are devoted to what I would call the connection aspect Connection means then essentially the use of the exact results of the Wiener process to get approximate results for the compound Poisson process (It might have been worthwhile to get the reader familiarized with the Donsker invariance principle) From practical trials (and independent of Grandell's warning) I have gained the impression that these approximations may become unreliable

In chapter six the reader learns about Kolmogorov statistics and Kac statistics Particularly the last ones have been little noticed in the actuarial literature inspite of the fact that they could be very useful for purposes of insurance statistics The book concludes by showing some applications in physics The problem of evaluating Feynman integrals dominates this chapter

Professor Beekman has written a very readable book At many junctions the reader may have to look up the original literature cited if he wants to perceive the details But "Two Stochastic Processes" may be the red threat of Ariadne on the way to a common interest of actuaries and theoretical physicists for stochastic processes and their applications

Hans BUHLMANN

KARL BORCH, *The Mathematical Theory of Insurance An Annotated Selection of Papers on Insurance published 1960-1972* D C Heath and Co Lexington, Mass , 1974

In May of 1969 the reviewer published the first book on the application of probability theory to general insurance business, the last of its six chapters was entitled "Utility Theory and Its Application to Reinsurance and Profit Prospects" Fourteen of the 35 references in this chapter were written by Karl Borch who has now collected most of them—and about a dozen other papers, some more recent—into the mis titled book quoted above As the author writes in his Preface " all the papers are in one way or another based on the application of game theory and decision theory to problems in insurance "

We do not recollect any other attempt to assemble a prolific author's output into a book developing a subject *ab initio* Borch has done this very cleverly by grouping his papers under five heads and by writing an introductory, explanatory note to each of these "Parts" Nevertheless the result suffers from heavy repetition which the author has made no attempt to remove In fact except for a few deletions of material, the papers are as originally written and the only novelty is the five introductory notes which strangely fail to mention DuMouchel's (1968) correction of Borch's important theorem on the Pareto optimality of an n company reinsurance treaty the utility function must have a non-increasing first derivative

An interesting feature of the book is that the articles have not been reproduced photographically but have been reprinted in a uniform format so that, for example all references appear as e g "Feller [15]" instead of what may have been "Feller (1948)" in the original This would have allowed the