

## Bonus Malus Systems North American Actuarial Journal

This textbook provides a broad overview of the present state of insurance mathematics and some related topics in risk management, financial mathematics and probability. Both non-life and life aspects are covered. The emphasis is on probability and modeling rather than statistics and practical implementation. Aimed at the graduate level, pointing in part to current research topics, it can potentially replace other textbooks on basic non-life insurance mathematics and advanced risk management methods in non-life insurance. Based on chapters selected according to the particular topics in mind, the book may serve as a source for introductory courses to insurance mathematics for non-specialists, advanced courses for actuarial students, or courses on probabilistic aspects of risk. It will also be useful for practitioners and students/researchers in related areas such as finance and statistics who wish to get an overview of the general area of mathematical modeling and analysis in insurance.

This book presents recent advances in the theory and implementation of intelligent and other computational techniques in the insurance industry. The paradigms covered encompass artificial neural networks and fuzzy systems, including clustering versions, optimization and resampling methods, algebraic and Bayesian models, decision trees and regression splines. Thus, the focus is not just on intelligent techniques, although these constitute a major component; the book also deals with other current computational paradigms that are likely to impact on the industry. The application areas include asset allocation, asset and liability management, cash-flow analysis, claim costs, classification, fraud detection, insolvency, investments, loss distributions, marketing, pricing and premiums, rate-making, retention, survival analysis, and underwriting.

This book presents a comparative analysis of energy efficiency policies in developing countries. Although there is a vast amount of literature available about renewable energy policy and implementation in the developing world, energy efficiency tends to lack attention. This book fills this lacuna by examining the current state of the field and scope for future improvements. Drawing on a wide range of case studies including Brazil, China and Chile, the authors use a comparative approach to examine the policies and programmes being implemented, looking at the existing legal frameworks and regulatory challenges. By showcasing stories of success, as well as barriers to energy efficiency, they highlight the opportunities for increased energy access and efficiency and demonstrate how these opportunities may directly impact on climate change mitigation. This volume will be a useful resource for scholars and practitioners with an interest in energy policy and efficiency, climate change and international development.

The increasing complexity of insurance and reinsurance products has seen a growing interest amongst actuaries in the modelling of dependent risks. For efficient risk management, actuaries need to be able to answer fundamental questions such as: Is the correlation structure dangerous? And, if yes, to what extent? Therefore tools to quantify, compare, and model the strength of dependence between different risks are vital. Combining coverage of stochastic order and risk measure theories with the basics of risk management and stochastic dependence, this book provides an essential guide to managing modern financial risk. \* Describes how to model risks in incomplete markets, emphasising insurance risks. \* Explains how to measure and compare the danger of risks, model their interactions, and measure the strength of their association. \* Examines the type of dependence induced by GLM-based credibility models, the bounds on functions of dependent risks, and probabilistic distances between actuarial models. \* Detailed presentation of risk measures, stochastic orderings, copula models,

dependence concepts and dependence orderings. \* Includes numerous exercises allowing a cementing of the concepts by all levels of readers. \* Solutions to tasks as well as further examples and exercises can be found on a supporting website. An invaluable reference for both academics and practitioners alike, Actuarial Theory for Dependent Risks will appeal to all those eager to master the up-to-date modelling tools for dependent risks. The inclusion of exercises and practical examples makes the book suitable for advanced courses on risk management in incomplete markets. Traders looking for practical advice on insurance markets will also find much of interest.

Readers will find, in this highly relevant and groundbreaking book, research ranging from applications in financial markets and business administration to various economics problems. Not only are empirical studies utilizing various CI algorithms presented, but so also are theoretical models based on computational methods. In addition to direct applications of computational intelligence, readers can also observe how these methods are combined with conventional analytical methods such as statistical and econometric models to yield preferred results. Global university rankings are now more than a decade old and this book uses the data they have produced to examine how the international landscape of universities has changed over the years. It offers new insights into the power and limits of league tables, a key element of globalized higher education that can be deplored but hardly ignored. Case studies from Asia, Europe and North America are explored to highlight the issues raised by a quantitative exercise that decontextualizes what is linked so strongly to local factors.

Distribution Models Theory is a revised edition of papers specially selected by the Scientific Committee for the Fifth Workshop of Spanish Scientific Association of Applied Economy on Distribution Models Theory held in Granada (Spain) in September 2005. The contributions offer a must-have point of reference on models theory. This book has been selected for coverage in: ? Index to Scientific & Technical Proceedings? (ISTP?/ISI Proceedings)? Index to Scientific & Technical Proceedings (ISTP CDRom version/ISI Proceedings)

These notes represent our summary of much of the recent research that has been done in recent years on approximations and bounds that have been developed for compound distributions and related quantities which are of interest in insurance and other areas of application in applied probability. The basic technique employed in the derivation of many bounds is inductive, an approach that is motivated by arguments used by Sparre-Andersen (1957) in connection with a renewal risk model in insurance. This technique is both simple and powerful, and yields quite general results. The bounds themselves are motivated by the classical Lundberg exponential bounds which apply to ruin probabilities, and the connection to compound distributions is through the interpretation of the ruin probability as the tail probability of a compound geometric distribution. The initial exponential bounds were given in Willmot and Lin (1994), followed by the nonexponential generalization in Willmot (1994). Other related work on approximations for compound distributions and applications to various problems in insurance in particular and applied probability in general is also discussed in subsequent chapters. The results obtained or the arguments employed in these situations are similar to those for the compound distributions, and thus we felt it useful to include them in the notes. In many cases we have included exact results, since these are useful in conjunction with the bounds and approximations developed.

An introduction to foundations and applications for quantitatively oriented graduate social-science students and individual researchers.

Motor vehicle accidents are still a leading cause of death, even if the trend has somewhat declined over the past 20 years. Indeed, motor vehicle accidents are a significant cause of death in comparison with air and space transport accidents, homicides and even HIV infections, causes which are more often highlighted in the media. As shown in this book, motor vehicle accidents are particularly damaging to very young drivers. The assessment of driving risks is a common concern for road transportation safety and the automobile insurance industry. In both cases, there is an awareness of the great losses resulting from the deaths, injuries and property damage caused by traffic accidents.

Research is essential to counteract this public health threat, to assess the success or failure of countermeasures, and to solve the problems it generates in the insurance industry. This book is for people concerned about road crashes (prevention and compensation) and about the insurance problems they pose - namely private and public institutional authorities, consultants, administrators, practitioners, and researchers interested in sharing the authors' experience in this domain. The book presents original contributions related to motor vehicle insurance and road safety. All papers have been evaluated by external referees. Four subjects are covered: 1) Automobile Insurance Pricing, Risks and Asymmetric Information; 2) Insurance Fraud; 3) Young Drivers: Licensing Policies, Evaluation and Risks; and 4) Road Insurance Regulation. Focusing on what actuaries need in practice, this introductory account provides readers with essential tools for handling complex problems and explains how simulation models can be created, used and re-used (with modifications) in related situations. The book begins by outlining the basic tools of modelling and simulation, including a discussion of the Monte Carlo method and its use. Part II deals with general insurance and Part III with life insurance and financial risk. Algorithms that can be implemented on any programming platform are spread throughout and a program library written in R is included. Numerous figures and experiments with R-code illustrate the text. The author's non-technical approach is ideal for graduate students, the only prerequisites being introductory courses in calculus and linear algebra, probability and statistics. The book will also be of value to actuaries and other analysts in the industry looking to update their skills.

The book contains important material on topics that are relevant for recent insurance and actuarial developments including determining solvency measures, fair-value computations, reserving, ranking of risks, modelling dependencies and the use of generalized linear models. Numerous exercises and the hints for solving them make the book useful as a textbook. Practical paradigms in insurance are presented in a way that is appealing to actuaries in their daily business.

There are a wide range of variables for actuaries to consider when calculating a motorist's insurance premium, such as age, gender and type of vehicle. Further to these factors, motorists' rates are subject to experience rating systems, including credibility mechanisms and Bonus Malus systems (BMSs). Actuarial Modelling of Claim Counts presents a comprehensive treatment of the various experience rating systems and their relationships with risk classification. The authors summarize the most recent developments in the field, presenting ratemaking systems, whilst taking into account exogenous information. The text: Offers the first self-contained, practical approach to a priori and a posteriori ratemaking in motor insurance. Discusses the issues of claim frequency and claim severity, multi-event systems, and the combinations of deductibles and BMSs. Introduces recent developments in actuarial science and exploits the generalised linear model and generalised linear mixed model to achieve risk classification. Presents credibility mechanisms as refinements of commercial BMSs. Provides practical applications with real data sets processed with SAS software. Actuarial Modelling of Claim Counts is essential reading for students in actuarial science, as well as practicing and academic actuaries. It is also ideally suited for professionals involved in the insurance industry, applied mathematicians, quantitative economists, financial engineers and statisticians.

This book teaches multiple regression and time series and how to use these to analyze real data in risk management and finance.

Machine learning is a relatively new field, without a unanimous definition. In many ways, actuaries have been machine learners. In both pricing and reserving, but also more recently in capital modelling, actuaries have combined statistical methodology with a deep understanding of the problem at hand and how any solution may affect the company and its customers. One aspect that has, perhaps, not been so well developed among actuaries is validation. Discussions among

actuaries' "preferred methods" were often without solid scientific arguments, including validation of the case at hand. Through this collection, we aim to promote a good practice of machine learning in insurance, considering the following three key issues: a) who is the client, or sponsor, or otherwise interested real-life target of the study? b) The reason for working with a particular data set and a clarification of the available extra knowledge, that we also call prior knowledge, besides the data set alone. c) A mathematical statistical argument for the validation procedure.

Modern Actuarial Risk Theory contains what every actuary needs to know about non-life insurance mathematics. It starts with the standard material like utility theory, individual and collective model and basic ruin theory. Other topics are risk measures and premium principles, bonus-malus systems, ordering of risks and credibility theory. It also contains some chapters about Generalized Linear Models, applied to rating and IBNR problems. As to the level of the mathematics, the book would fit in a bachelors or masters program in quantitative economics or mathematical statistics. This second and. This Annual Report provides an account of the actions the 41 adhering governments have taken over the 12 months to June 2009 to enhance the contribution of the Guidelines to the improved functioning of the global economy. It also contains a report on consumer empowerment.

Modern Statistical, Systems, and GPSS Simulation, Second Edition introduces the theory and implementation of discrete-event simulation. This text: establishes a theoretical basis for simulation methodology provides details of an important simulation language (GPSS - General Purpose Simulation System) integrates these two elements in a systems simulation case study Valuable additions to the second edition include coverage of random number generators with astronomic period, new entropy-based tests of uniformity, gamma variate generation, results on the GLD, and variance reduction techniques. GPSS/PC is an interactive implementation of GPSS for the IBM-PC compatible family of microcomputers. The disk accompanying Modern Statistical, Systems, and GPSS Simulation contains the limited educational version of GPSS/PC with many illustrative examples discussed in the text.

This book provides an overview of classical actuarial techniques, including material that is not readily accessible elsewhere such as the Ammeter risk model and the Markov-modulated risk model. Other topics covered include utility theory, credibility theory, claims reserving and ruin theory. The author treats both theoretical and practical aspects and also discusses links to Solvency II. Written by one of the leading experts in the field, these lecture notes serve as a valuable introduction to some of the most frequently used methods in non-life insurance. They will be of particular interest to graduate students, researchers and practitioners in insurance, finance and risk management.

Handbook of International Insurance: Between Global Dynamics and Local Contingencies analyzes key trends in the insurance industry in more than 15 important national insurance markets that represent over 90 percent of world

insurance premiums. Well-known academics from Europe, the Americas and Asia examine their own national insurance markets, including the competitive structure, product and service innovations, and regulatory developments. The book provides academics and executives with an unprecedented range of information about today's insurance markets. This book also provides important 'new' information on the evolution of the financial sector worldwide and comprehensive chapters on reinsurance, Lloyd's of London, alternative risk transfer, South and East Asian insurance markets, and European insurance markets. Setting the stage is an overview chapter by the editors focusing on overall conclusions on globalization.

The theory of insurance is presented in this book, discussed from the viewpoint of the theory of economics of uncertainty. The principle of premium calculation which the book uses is based on economic equilibrium theory and differs from many of the premium systems discussed by actuaries. Reinsurance is developed in the framework of general economic equilibrium theory under uncertainty. Here ordering of risks, preferences and utility theory play an important role. The book discusses the markets for insurance and divides them into three classes: (i) life insurance (ii) business insurance and (iii) household insurance, and these classes are each treated extensively in three separate chapters. Finally uninsurable risks are presented under "asymmetric information". Here moral hazard and adverse selection are treated and illustrations are given, some based on game theory.

Statistical science as organized in formal academic departments is relatively new. With a few exceptions, most Statistics and Biostatistics departments have been created within the past 60 years. This book consists of a set of memoirs, one for each department in the U.S. created by the mid-1960s. The memoirs describe key aspects of the department's history -- its founding, its growth, key people in its development, success stories (such as major research accomplishments) and the occasional failure story, PhD graduates who have had a significant impact, its impact on statistical education, and a summary of where the department stands today and its vision for the future. Read here all about how departments such as at Berkeley, Chicago, Harvard, and Stanford started and how they got to where they are today. The book should also be of interests to scholars in the field of disciplinary history.

The research on human intelligence is based on almost all disciplines of modern science. The following questions must be answered: What is information? How does information processing emerge? Can we trace the long and tortuous path of biotic evolution from reflex, through instinct, towards intelligence? The brain, as the most complex system of macro- and micro-structures, unifies energetic, electrical and chemical phenomena and carries human intelligence. Brain functions include memory, emotions, attention, etc. Are there gender differences? Speech, self-consciousness and the feeling of free will are tools of intelligence. What about genius, common sense and personality? Lies, myths, aesthetics and morality are inseparable parts of human intelligence. What about the chances and threats for human intelligence in the distant future? M Taube, a nuclear chemist specializing in the cosmic evolution of matter and energy, and K Leenders, an academic neurologist and head of the positron emission tomography (PET) program at the Paul Scherrer Institute, address those questions in this fascinating book on human intelligence. Contents: Intelligence and Information Universe Creates Life Life Breeds Intelligence Brain Carries

IntelligenceBrain Processes IntelligenceTools of IntelligenceEveryday IntelligenceIntelligence InsideArtificial IntelligenceExtraterrestrial IntelligenceFuture Intelligence Readership: General. keywords:Intelligence;Evolution of Artificial Intelligence;Evolution of Extraterrestrial Intelligence;Evolution of Common Sense;Evolution of Creativity;Evolution of Deception;Evolution of Disordered Intelligence;Evolution of Future of Intelligence;Evolution of Psychactive Agents;Evolution of Brain, Neurons, Synapses

This class-tested undergraduate textbook covers the entire syllabus for Exam C of the Society of Actuaries (SOA).

The mathematical theory of non-life insurance developed much later than the theory of life insurance. The problems that occur in the former field are far more intricate for several reasons: 1. In the field of life insurance, the company usually has to pay a claim on the policy only once: the insured dies or the policy matures only once. It is with only a few particular types of policy (for instance, sickness insurance, when the insured starts working again after a period of sickness) that a valid claim can be made on a number of different occasions. On the other hand, the general rule in non-life insurance is that the policyholder is liable to be the victim of several losses (in automobile insurance, of course, but also in burglary and fire insurance, householders' comprehensive insurance, and so on). 2. In the field of life insurance, the amount to be paid by the company excluding any bonuses-is determined at the inception of the policy. For the various types of life insurance contracts, the sum payable on death or at maturity of the policy is known in advance. In the field of non-life insurance, the amount of a loss is a random variable: the cost of an automobile crash, the partial or total loss of a building as a result of fire, the number and nature of injuries, and so forth.

Over the past two decades, the United States has successfully deregulated prices and restrictions on most previously-regulated industries, including airlines, trucking, railroads, telecommunications, and banking. Only a few industries remain regulated, the largest being the property-liability insurance business. In light of recent sweeping financial modernization legislation in other sectors of the insurance industry, this timely volume examines the basis for continued regulation of rates and forms of the U.S. property-liability insurance market. The book focuses on private passenger automobile insurance—the most important personal line of property-liability coverage, with annual premiums of about \$120 billion. The authors analyze five state case studies: California, Massachusetts, and New Jersey—three of the most heavily regulated states—as well as Illinois, which has been deregulated for about 30 years, and South Carolina, which began to deregulate in 1997. The study also includes an econometric analysis based on all fifty states over a 25-year period that gauges the impact of regulation on insurance price levels, price volatility, and the proportion of automobiles insured in residual markets. The authors conclude that regulation does not significantly reduce long-run prices for consumers, and generally limits availability of coverage, reduces the quality and variety of services available in the market, inhibits productivity growth, and increases price volatility. Contributors include Dwight Jaffee (University of California, Berkeley), Thomas Russell (Santa Clara University), Laureen Regan (Temple University), Sharon Tennyson (Cornell University), Mary Weiss (Temple University), John Worrall (Rutgers University), Stephen D'Arcy (University of Illinois, Urbana-Champaign), Martin Grace (Georgia State University), Robert Klein (Georgia State University), Richard Phillips (Georgia State University), Georges Dionne (University of Montreal), and Richard Butler (Brigham Young University).

Non-life insurance pricing is the art of setting the price of an insurance policy, taking into consideration various properties of the insured object and the policy holder. Introduced by British actuaries generalized linear models (GLMs) have become today a the standard approach for tariff analysis. The book focuses on methods based on GLMs that have been found useful in actuarial practice and provides a set of tools for a tariff analysis. Basic theory of GLMs in a tariff analysis setting is presented with useful extensions of standard GLM theory that are not in common use. The book meets the European Core Syllabus for actuarial education and is written for actuarial students as well as practicing

actuaries. To support reader real data of some complexity are provided at [www.math.su.se/GLMbook](http://www.math.su.se/GLMbook).

Risk Measures and Insurance Solvency Benchmarks: Fixed-Probability Levels in Renewal Risk Models is written for academics and practitioners who are concerned about potential weaknesses of the Solvency II regulatory system. It is also intended for readers who are interested in pure and applied probability, have a taste for classical and asymptotic analysis, and are motivated to delve into rather intensive calculations. The formal prerequisite for this book is a good background in analysis. The desired prerequisite is some degree of probability training, but someone with knowledge of the classical real-variable theory, including asymptotic methods, will also find this book interesting. For those who find the proofs too complicated, it may be reassuring that most results in this book are formulated in rather elementary terms. This book can also be used as reading material for basic courses in risk measures, insurance mathematics, and applied probability. The material of this book was partly used by the author for his courses in several universities in Moscow, Copenhagen University, and in the University of Montreal. Features Requires only minimal mathematical prerequisites in analysis and probability Suitable for researchers and postgraduate students in related fields Could be used as a supplement to courses in risk measures, insurance mathematics and applied probability.

This volume explores the central issues driving the present process of healthcare reform in Europe. 17 chapters written by scholars and policy makers from all parts of Europe draw together the available evidence from epidemiology and public health, economics, public policy, organizational behaviour and management theory as well as real world policy making experience, laying out the options that health sector decision-makers confront. Through its cross-disciplinary, cross-national approach, the book highlights the underlying trends that now influence health policy formulation across Europe. An authoritative introduction provides a broad synthesis of present trends and strategies in European health policy.

Most insurers around the world have introduced some form of merit-rating in automobile third party liability insurance. Such systems, penalizing at-fault accidents by premium surcharges and rewarding claim-free years by discounts, are called bonus-malus systems (BMS) in Europe and Asia. With the current deregulation trends that concern most insurance markets around the world, many companies will need to develop their own BMS. The main objective of the book is to provide them models to design BMS that meet their objectives. Part I of the book contains an overall presentation of the pros and cons of merit-rating, a case study and a review of the different probability distributions that can be used to model the number of claims in an automobile portfolio. In Part II, 30 systems from 22 different countries, are evaluated and ranked according to their 'toughness' towards policyholders. Four tools are created to evaluate that toughness and provide a tentative classification of all systems. Then, factor analysis is used to aggregate and summarize the data, and provide a final ranking of all systems. Part III is an up-to-date review of all the probability models that have been proposed for the design of an optimal BMS. The application of these models would enable the reader to devise the system that is ideally suited to the behavior of the policyholders of his own insurance company. Finally, Part IV analyses an alternative to BMS; the introduction of a policy with a deductible.

This new edition of the Handbook of Insurance reviews the last forty years of research developments in insurance and its related fields. A single reference source for professors, researchers, graduate students, regulators, consultants and practitioners, the book

starts with the history and foundations of risk and insurance theory, followed by a review of prevention and precaution, asymmetric information, risk management, insurance pricing, new financial innovations, reinsurance, corporate governance, capital allocation, securitization, systemic risk, insurance regulation, the industrial organization of insurance markets and other insurance market applications. It ends with health insurance, longevity risk, long-term care insurance, life insurance financial products and social insurance. This second version of the Handbook contains 15 new chapters. Each of the 37 chapters has been written by leading authorities in risk and insurance research, all contributions have been peer reviewed, and each chapter can be read independently of the others.

Bonus-Malus Systems in Automobile Insurance Springer Science & Business Media

Leading the way in this field, the Encyclopedia of Quantitative Risk Analysis and Assessment is the first publication to offer a modern, comprehensive and in-depth resource to the huge variety of disciplines involved. A truly international work, its coverage ranges across risk issues pertinent to life scientists, engineers, policy makers, healthcare professionals, the finance industry, the military and practising statisticians. Drawing on the expertise of world-renowned authors and editors in this field this title provides up-to-date material on drug safety, investment theory, public policy applications, transportation safety, public perception of risk, epidemiological risk, national defence and security, critical infrastructure, and program management. This major publication is easily accessible for all those involved in the field of risk assessment and analysis. For ease-of-use it is available in print and online.

The effective utilization of available resources is a pivotal factor for production levels in modern business environments. However, when resources are limited or in excess, this effects organizational success, as well as the labor market. The Handbook of Research on Unemployment and Labor Market Sustainability in the Era of Globalization is a comprehensive reference source for the latest scholarly research on the socio-economic dynamics of unemployment and the development of new policies to assist in regulating the global labor market. Highlighting innovative approaches and relevant perspectives, such as outsourcing, trade openness, and employment protection, this publication is ideally designed for policy makers, professionals, practitioners, graduate students, and academics interested in emerging trends for labor market development.

The book gives a comprehensive treatment of the classical and modern ruin probability theory. Some of the topics are Lundberg's inequality, the Cram, $r$ ?Lundberg approximation, exact solutions, other approximations (e.g., for heavy-tailed claim size distributions), finite horizon ruin probabilities, extensions of the classical compound Poisson model to allow for reserve-dependent premiums, Markov-modulation, periodicity, change of measure techniques, phase-type distributions as a computational vehicle and the connection to other applied probability areas, like queueing theory. In this substantially updated and extended second version, new topics include stochastic control, fluctuation theory for Levy processes, Gerber?Shiu functions and dependence.

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