

WILEY SERIES IN PROBABILITY AND STATISTICS

ESTABLISHED BY WALTER A. SHEWHART AND SAMUEL S. WILKS

Editors: *David J. Balding, Noel A. C. Cressie, Nicholas I. Fisher,
Iain M. Johnstone, J. B. Kadane, Louise M. Ryan, David W. Scott,
Adrian F. M. Smith, Jozef L. Teugels*
Editors Emeriti: *Vic Barnett, J. Stuart Hunter, David G. Kendall*

The **Wiley Series in Probability and Statistics** is well established and authoritative. It covers many topics of current research interest in both pure and applied statistics and probability theory. Written by leading statisticians and institutions, the titles span both state-of-the-art developments in the field and classical methods.

Reflecting the wide range of current research in statistics, the series encompasses applied, methodological and theoretical statistics, ranging from applications and new techniques made possible by advances in computerized practice to rigorous treatment of theoretical approaches.

This series provides essential and invaluable reading for all statisticians, whether in academia, industry, government, or research.

- ABRAHAM and LEDOLTER · Statistical Methods for Forecasting
AGRESTI · Analysis of Ordinal Categorical Data
AGRESTI · An Introduction to Categorical Data Analysis
AGRESTI · Categorical Data Analysis, *Second Edition*
ALTMAN, GILL, and McDONALD · Numerical Issues in Statistical Computing for the
Social Scientist
AMARATUNGA and CABRERA · Exploration and Analysis of DNA Microarray and
Protein Array Data
ANDÉL · Mathematics of Chance
ANDERSON · An Introduction to Multivariate Statistical Analysis, *Third Edition*
*ANDERSON · The Statistical Analysis of Time Series
ANDERSON, AUQUIER, HAUCK, OAKES, VANDAELE, and WEISBERG ·
Statistical Methods for Comparative Studies
ANDERSON and LOYNES · The Teaching of Practical Statistics
ARMITAGE and DAVID (editors) · Advances in Biometry
ARNOLD, BALAKRISHNAN, and NAGARAJA · Records
*ARTHANARI and DODGE · Mathematical Programming in Statistics
*BAILEY · The Elements of Stochastic Processes with Applications to the Natural
Sciences
BALAKRISHNAN and KOUTRAS · Runs and Scans with Applications
BARNETT · Comparative Statistical Inference, *Third Edition*
BARNETT and LEWIS · Outliers in Statistical Data, *Third Edition*
BARTOSZYNSKI and NIEWIADOMSKA-BUGAJ · Probability and Statistical Inference
BASILEVSKY · Statistical Factor Analysis and Related Methods: Theory and
Applications
BASU and RIGDON · Statistical Methods for the Reliability of Repairable Systems
BATES and WATTS · Nonlinear Regression Analysis and Its Applications
BECHHOFFER, SANTNER, and GOLDSMAN · Design and Analysis of Experiments for
Statistical Selection, Screening, and Multiple Comparisons
BELSLEY · Conditioning Diagnostics: Collinearity and Weak Data in Regression

BELSLEY, KUH, and WELSCH · Regression Diagnostics: Identifying Influential Data and Sources of Collinearity

BENDAT and PIERSON · Random Data: Analysis and Measurement Procedures, *Third Edition*

BERRY, CHALONER, and GEWEKE · Bayesian Analysis in Statistics and Econometrics: Essays in Honor of Arnold Zellner

BERNARDO and SMITH · Bayesian Theory

BHAT and MILLER · Elements of Applied Stochastic Processes, *Third Edition*

BHATTACHARYA and JOHNSON · Statistical Concepts and Methods

BHATTACHARYA and WAYMIRE · Stochastic Processes with Applications

BILLINGSLEY · Convergence of Probability Measures, *Second Edition*

BILLINGSLEY · Probability and Measure, *Third Edition*

BIRKES and DODGE · Alternative Methods of Regression

BLISCHKE AND MURTHY (editors) · Case Studies in Reliability and Maintenance

BLISCHKE AND MURTHY · Reliability: Modeling, Prediction, and Optimization

BLOOMFIELD · Fourier Analysis of Time Series: An Introduction, *Second Edition*

BOLLEN · Structural Equations with Latent Variables

BOROVKOV · Ergodicity and Stability of Stochastic Processes

BOULEAU · Numerical Methods for Stochastic Processes

BOX · Bayesian Inference in Statistical Analysis

BOX · R. A. Fisher, the Life of a Scientist

BOX and DRAPER · Empirical Model-Building and Response Surfaces

*BOX and DRAPER · Evolutionary Operation: A Statistical Method for Process Improvement

BOX, HUNTER, and HUNTER · Statistics for Experimenters: An Introduction to Design, Data Analysis, and Model Building

BOX and LUCENO · Statistical Control by Monitoring and Feedback Adjustment

BRANDIMARTE · Numerical Methods in Finance: A MATLAB-Based Introduction

BROWN and HOLLANDER · Statistics: A Biomedical Introduction

BRUNNER, DOMHOF, and LANGER · Nonparametric Analysis of Longitudinal Data in Factorial Experiments

BUCKLEW · Large Deviation Techniques in Decision, Simulation, and Estimation

CAIROLI and DALANG · Sequential Stochastic Optimization

CHAN · Time Series: Applications to Finance

CHATTERJEE and HADI · Sensitivity Analysis in Linear Regression

CHATTERJEE and PRICE · Regression Analysis by Example, *Third Edition*

CHERNICK · Bootstrap Methods: A Practitioner's Guide

CHERNICK and FRIIS · Introductory Biostatistics for the Health Sciences

CHILÈS and DELFINER · Geostatistics: Modeling Spatial Uncertainty

CHOW and LIU · Design and Analysis of Clinical Trials: Concepts and Methodologies, *Second Edition*

CLARKE and DISNEY · Probability and Random Processes: A First Course with Applications, *Second Edition*

*COCHRAN and COX · Experimental Designs, *Second Edition*

CONGDON · Bayesian Statistical Modelling

CONOVER · Practical Nonparametric Statistics, *Second Edition*

COOK · Regression Graphics

COOK and WEISBERG · Applied Regression Including Computing and Graphics

COOK and WEISBERG · An Introduction to Regression Graphics

CORNELL · Experiments with Mixtures, Designs, Models, and the Analysis of Mixture Data, *Third Edition*

COVER and THOMAS · Elements of Information Theory

COX · A Handbook of Introductory Statistical Methods

*Now available in a lower priced paperback edition in the Wiley Classics Library.

- *COX · Planning of Experiments
- CRESSIE · Statistics for Spatial Data, *Revised Edition*
- CSÖRGŐ and HORVÁTH · Limit Theorems in Change Point Analysis
- DANIEL · Applications of Statistics to Industrial Experimentation
- DANIEL · Biostatistics: A Foundation for Analysis in the Health Sciences, *Sixth Edition*
- *DANIEL · Fitting Equations to Data: Computer Analysis of Multifactor Data, *Second Edition*
- DASU and JOHNSON · Exploratory Data Mining and Data Cleaning
- DAVID and NAGARAJA · Order Statistics, *Third Edition*
- *DEGROOT, FIENBERG, and KADANE · Statistics and the Law
- DEL CASTILLO · Statistical Process Adjustment for Quality Control
- DETTE and STUDDEN · The Theory of Canonical Moments with Applications in Statistics, Probability, and Analysis
- DEY and MUKERJEE · Fractional Factorial Plans
- DILLON and GOLDSTEIN · Multivariate Analysis: Methods and Applications
- DODGE · Alternative Methods of Regression
- *DODGE and ROMIG · Sampling Inspection Tables, *Second Edition*
- *DOOB · Stochastic Processes
- DOWDY, WEARDEN, and CHILKO · Statistics for Research, *Third Edition*
- DRAPER and SMITH · Applied Regression Analysis, *Third Edition*
- DRYDEN and MARDIA · Statistical Shape Analysis
- DUDEWICZ and MISHRA · Modern Mathematical Statistics
- DUNN and CLARK · Applied Statistics: Analysis of Variance and Regression, *Second Edition*
- DUNN and CLARK · Basic Statistics: A Primer for the Biomedical Sciences, *Third Edition*
- DUPUIS and ELLIS · A Weak Convergence Approach to the Theory of Large Deviations
- *ELANDT-JOHNSON and JOHNSON · Survival Models and Data Analysis
- ENDERS · Applied Econometric Time Series
- ETHIER and KURTZ · Markov Processes: Characterization and Convergence
- EVANS, HASTINGS, and PEACOCK · Statistical Distributions, *Third Edition*
- FELLER · An Introduction to Probability Theory and Its Applications, Volume I, *Third Edition, Revised; Volume II, Second Edition*
- FISHER and VAN BELLE · Biostatistics: A Methodology for the Health Sciences
- *FLEISS · The Design and Analysis of Clinical Experiments
- FLEISS · Statistical Methods for Rates and Proportions, *Third Edition*
- FLEMING and HARRINGTON · Counting Processes and Survival Analysis
- FULLER · Introduction to Statistical Time Series, *Second Edition*
- FULLER · Measurement Error Models
- GALLANT · Nonlinear Statistical Models
- GIESBRECHT and GUMPERTZ · Planning, Construction, and Statistical Analysis of Comparative Experiments
- GIFI · Nonlinear Multivariate Analysis
- GHOSH, MUKHOPADHYAY, and SEN · Sequential Estimation
- GIFI · Nonlinear Multivariate Analysis
- GLASSERMAN and YAO · Monotone Structure in Discrete-Event Systems
- GNANADESIKAN · Methods for Statistical Data Analysis of Multivariate Observations, *Second Edition*
- GOLDSTEIN and LEWIS · Assessment: Problems, Development, and Statistical Issues
- GREENWOOD and NIKULIN · A Guide to Chi-Squared Testing
- GROSS and HARRIS · Fundamentals of Queueing Theory, *Third Edition*
- *HAHN and SHAPIRO · Statistical Models in Engineering
- HAHN and MEEKER · Statistical Intervals: A Guide for Practitioners

*Now available in a lower priced paperback edition in the Wiley Classics Library.

HALD · A History of Probability and Statistics and their Applications Before 1750
 HALD · A History of Mathematical Statistics from 1750 to 1930
 HAMPEL · Robust Statistics: The Approach Based on Influence Functions
 HANNAN and DEISTLER · The Statistical Theory of Linear Systems
 HEIBERGER · Computation for the Analysis of Designed Experiments
 HEDAYAT and SINHA · Design and Inference in Finite Population Sampling
 HELLER · MACSYMA for Statisticians
 HINKELMAN and KEMPTHORNE · Design and Analysis of Experiments, Volume 1:
 Introduction to Experimental Design
 HOAGLIN, MOSTELLER, and TUKEY · Exploratory Approach to Analysis
 of Variance
 HOAGLIN, MOSTELLER, and TUKEY · Exploring Data Tables, Trends and Shapes
 *HOAGLIN, MOSTELLER, and TUKEY · Understanding Robust and Exploratory
 Data Analysis
 HOCHBERG and TAMHANE · Multiple Comparison Procedures
 HOCKING · Methods and Applications of Linear Models: Regression and the Analysis
 of Variance, *Second Edition*
 HOEL · Introduction to Mathematical Statistics, *Fifth Edition*
 HOGG and KLUGMAN · Loss Distributions
 HOLLANDER and WOLFE · Nonparametric Statistical Methods, *Second Edition*
 HOSMER and LEMESHOW · Applied Logistic Regression, *Second Edition*
 HOSMER and LEMESHOW · Applied Survival Analysis: Regression Modeling of
 Time to Event Data
 HØYLAND and RAUSAND · System Reliability Theory: Models and Statistical Methods
 HUBER · Robust Statistics
 HUBERTY · Applied Discriminant Analysis
 HUNT and KENNEDY · Financial Derivatives in Theory and Practice
 HUSKOVA, BERAN, and DUPAC · Collected Works of Jaroslav Hajek—
 with Commentary
 IMAN and CONOVER · A Modern Approach to Statistics
 JACKSON · A User's Guide to Principle Components
 JOHN · Statistical Methods in Engineering and Quality Assurance
 JOHNSON · Multivariate Statistical Simulation
 JOHNSON and BALAKRISHNAN · Advances in the Theory and Practice of Statistics: A
 Volume in Honor of Samuel Kotz
 JUDGE, GRIFFITHS, HILL, LÜTKEPOHL, and LEE · The Theory and Practice of
 Econometrics, *Second Edition*
 JOHNSON and KOTZ · Distributions in Statistics
 JOHNSON and KOTZ (editors) · Leading Personalities in Statistical Sciences: From the
 Seventeenth Century to the Present
 JOHNSON, KOTZ, and BALAKRISHNAN · Continuous Univariate Distributions,
 Volume 1, *Second Edition*
 JOHNSON, KOTZ, and BALAKRISHNAN · Continuous Univariate Distributions,
 Volume 2, *Second Edition*
 JOHNSON, KOTZ, and BALAKRISHNAN · Discrete Multivariate Distributions
 JOHNSON, KOTZ, and KEMP · Univariate Discrete Distributions, *Second Edition*
 JUREČKOVÁ and SEN · Robust Statistical Procedures: Asymptotics and Interrelations
 JUREK and MASON · Operator-Limit Distributions in Probability Theory
 KADANE · Bayesian Methods and Ethics in a Clinical Trial Design
 KADANE AND SCHUM · A Probabilistic Analysis of the Sacco and Vanzetti Evidence
 KALBFLEISCH and PRENTICE · The Statistical Analysis of Failure Time Data, *Second
 Edition*
 KASS and VOS · Geometrical Foundations of Asymptotic Inference

*Now available in a lower priced paperback edition in the Wiley Classics Library.

KAUFMAN and ROUSSEEUW · Finding Groups in Data: An Introduction to Cluster Analysis

KEDEM and FOKIANOS · Regression Models for Time Series Analysis

KENDALL, BARDEN, CARNE, and LE · Shape and Shape Theory

KHURI · Advanced Calculus with Applications in Statistics, *Second Edition*

KHURI, MATHEW, and SINHA · Statistical Tests for Mixed Linear Models

KLEIBER and KOTZ · Statistical Size Distributions in Economics and Actuarial Sciences

KLUGMAN, PANJER, and WILLMOT · Loss Models: From Data to Decisions

KLUGMAN, PANJER, and WILLMOT · Solutions Manual to Accompany Loss Models: From Data to Decisions

KOTZ, BALAKRISHNAN, and JOHNSON · Continuous Multivariate Distributions, Volume 1, *Second Edition*

KOTZ and JOHNSON (editors) · Encyclopedia of Statistical Sciences: Volumes 1 to 9 with Index

KOTZ and JOHNSON (editors) · Encyclopedia of Statistical Sciences: Supplement Volume

KOTZ, READ, and BANKS (editors) · Encyclopedia of Statistical Sciences: Update Volume 1

KOTZ, READ, and BANKS (editors) · Encyclopedia of Statistical Sciences: Update Volume 2

KOVALENKO, KUZNETZOV, and PEGG · Mathematical Theory of Reliability of Time-Dependent Systems with Practical Applications

LACHIN · Biostatistical Methods: The Assessment of Relative Risks

LAD · Operational Subjective Statistical Methods: A Mathematical, Philosophical, and Historical Introduction

LAMPERTI · Probability: A Survey of the Mathematical Theory, *Second Edition*

ANGE, RYAN, BILLARD, BRILLINGER, CONQUEST, and GREENHOUSE · Case Studies in Biometry

LARSON · Introduction to Probability Theory and Statistical Inference, *Third Edition*

LAWLESS · Statistical Models and Methods for Lifetime Data, *Second Edition*

LAWSON · Statistical Methods in Spatial Epidemiology

LE · Applied Categorical Data Analysis

LE · Applied Survival Analysis

LEE and WANG · Statistical Methods for Survival Data Analysis, *Third Edition*

LEPAGE and BILLARD · Exploring the Limits of Bootstrap

LEYLAND and GOLDSTEIN (editors) · Multilevel Modelling of Health Statistics

LIAO · Statistical Group Comparison

LINDVALL · Lectures on the Coupling Method

LINHART and ZUCCHINI · Model Selection

LITTLE and RUBIN · Statistical Analysis with Missing Data, *Second Edition*

LLOYD · The Statistical Analysis of Categorical Data

MAGNUS and NEUDECKER · Matrix Differential Calculus with Applications in Statistics and Econometrics, *Revised Edition*

MALLER and ZHOU · Survival Analysis with Long Term Survivors

MALLOWS · Design, Data, and Analysis by Some Friends of Cuthbert Daniel

MANN, SCHAFER, and SINGPURWALLA · Methods for Statistical Analysis of Reliability and Life Data

MANTON, WOODBURY, and TOLLEY · Statistical Applications Using Fuzzy Sets

MARDIA and JUPP · Directional Statistics

MASON, GUNST, and HESS · Statistical Design and Analysis of Experiments with Applications to Engineering and Science, *Second Edition*

McCULLOCH and SEARLE · Generalized, Linear, and Mixed Models

McFADDEN · Management of Data in Clinical Trials

*Now available in a lower priced paperback edition in the Wiley Classics Library.

McLACHLAN · Discriminant Analysis and Statistical Pattern Recognition
 McLACHLAN and KRISHNAN · The EM Algorithm and Extensions
 McLACHLAN and PEEL · Finite Mixture Models
 McNEIL · Epidemiological Research Methods
 MEEKER and ESCOBAR · Statistical Methods for Reliability Data
 MEERSCHAERT and SCHEFFLER · Limit Distributions for Sums of Independent
 Random Vectors: Heavy Tails in Theory and Practice
 *MILLER · Survival Analysis, *Second Edition*
 MONTGOMERY, PECK, and VINING · Introduction to Linear Regression Analysis,
Third Edition
 MORGENTHAUER and TUKEY · Configural Polysampling: A Route to Practical
 Robustness
 MUIRHEAD · Aspects of Multivariate Statistical Theory
 MURRAY · X-STAT 2.0 Statistical Experimentation, Design Data Analysis, and
 Nonlinear Optimization
 MURTHY, XIE, and JIANG · Weibull Models
 MYERS and MONTGOMERY · Response Surface Methodology: Process and Product
 Optimization Using Designed Experiments, *Second Edition*
 MYERS, MONTGOMERY, and VINING · Generalized Linear Models. With
 Applications in Engineering and the Sciences
 NELSON · Accelerated Testing, Statistical Models, Test Plans, and Data Analyses
 NELSON · Applied Life Data Analysis
 NEWMAN · Biostatistical Methods in Epidemiology
 OCHI · Applied Probability and Stochastic Processes in Engineering and Physical
 Sciences
 OKABE, BOOTS, SUGIHARA, and CHIU · Spatial Tessellations: Concepts and
 Applications of Voronoi Diagrams, *Second Edition*
 OLIVER and SMITH · Influence Diagrams, Belief Nets and Decision Analysis
 PALTA · Quantitative Methods in Population Health: Extensions of Ordinary Regressions
 PANKRATZ · Forecasting with Dynamic Regression Models
 PANKRATZ · Forecasting with Univariate Box-Jenkins Models: Concepts and Cases
 *PARZEN · Modern Probability Theory and Its Applications
 PEÑA, TIAO, and TSAY · A Course in Time Series Analysis
 PIANTADOSI · Clinical Trials: A Methodologic Perspective
 PORT · Theoretical Probability for Applications
 POURAHMADI · Foundations of Time Series Analysis and Prediction Theory
 PRESS · Bayesian Statistics: Principles, Models, and Applications
 PRESS · Subjective and Objective Bayesian Statistics, *Second Edition*
 PRESS and TANUR · The Subjectivity of Scientists and the Bayesian Approach
 PUKELSHEIM · Optimal Experimental Design
 PURI, VILAPLANA, and WERTZ · New Perspectives in Theoretical and Applied
 Statistics
 PUTERMAN · Markov Decision Processes: Discrete Stochastic Dynamic Programming
 *RAO · Linear Statistical Inference and Its Applications, *Second Edition*
 RENCHER · Linear Models in Statistics
 RENCHER · Methods of Multivariate Analysis, *Second Edition*
 RENCHER · Multivariate Statistical Inference with Applications
 RIPLEY · Spatial Statistics
 RIPLEY · Stochastic Simulation
 ROBINSON · Practical Strategies for Experimenting
 ROHATGI and SALEH · An Introduction to Probability and Statistics, *Second Edition*
 ROLSKI, SCHMIDT, and TEUGELS · Stochastic Processes for Insurance
 and Finance
 ROSENBERGER and LACHIN · Randomization in Clinical Trials: Theory and Practice

*Now available in a lower priced paperback edition in the Wiley Classics Library.

ROSS · Introduction to Probability and Statistics for Engineers and Scientists
 ROUSSEEuw and LEROY · Robust Regression and Outlier Detection
 RUBIN · Multiple Imputation for Nonresponse in Surveys
 RUBINSTEIN · Simulation and the Monte Carlo Method
 RUBINSTEIN and MELAMED · Modern Simulation and Modeling
 RYAN · Modern Regression Methods
 RYAN · Statistical Methods for Quality Improvement, *Second Edition*
 SALTELLI, CHAN, and SCOTT (editors) · Sensitivity Analysis
 *SCHEFFE · The Analysis of Variance
 SCHIMEK · Smoothing and Regression: Approaches, Computation, and Application
 SCHOTT · Matrix Analysis for Statistics
 SCHUSS · Theory and Applications of Stochastic Differential Equations
 SCOTT · Multivariate Density Estimation: Theory, Practice, and Visualization
 *SEARLE · Linear Models
 SEARLE · Linear Models for Unbalanced Data
 SEARLE · Matrix Algebra Useful for Statistics
 SEARLE, CASELLA, and McCULLOCH · Variance Components
 SEARLE and WILLETT · Matrix Algebra for Applied Economics
 SEBER and LEE · Linear Regression Analysis, *Second Edition*
 SEBER · Multivariate Observations
 SEBER and WILD · Nonlinear Regression
 SENNOTT · Stochastic Dynamic Programming and the Control of Queueing Systems
 *SERFLING · Approximation Theorems of Mathematical Statistics
 SHAFER and VOVK · Probability and Finance: It's Only a Game!
 SMALL and McLEISH · Hilbert Space Methods in Probability and Statistical Inference
 SRIVASTAVA · Methods of Multivariate Statistics
 STAPLETON · Linear Statistical Models
 STAUDTE and SHEATHER · Robust Estimation and Testing
 STOYAN, KENDALL, and MECKE · Stochastic Geometry and Its Applications, *Second Edition*
 STOYAN and STOYAN · Fractals, Random Shapes and Point Fields: Methods of Geometrical Statistics
 STYAN · The Collected Papers of T. W. Anderson: 1943–1985
 SUTTON, ABRAMS, JONES, SHELDON, and SONG · Methods for Meta-Analysis in Medical Research
 TANAKA · Time Series Analysis: Nonstationary and Noninvertible Distribution Theory
 THOMPSON · Empirical Model Building
 THOMPSON · Sampling, *Second Edition*
 THOMPSON · Simulation: A Modeler's Approach
 THOMPSON and SEBER · Adaptive Sampling
 THOMPSON, WILLIAMS, and FINDLAY · Models for Investors in Real World Markets
 TIAO, BISGAARD, HILL, PEÑA, and STIGLER (editors) · Box on Quality and Discovery: with Design, Control, and Robustness
 TIERNEY · LISP-STAT: An Object-Oriented Environment for Statistical Computing and Dynamic Graphics
 TSAY · Analysis of Financial Time Series
 UPTON and FINGLETON · Spatial Data Analysis by Example, Volume II: Categorical and Directional Data
 VAN BELLE · Statistical Rules of Thumb
 VESTRUP · The Theory of Measures and Integration
 VIDAKOVIC · Statistical Modeling by Wavelets
 WEISBERG · Applied Linear Regression, *Second Edition*
 WELSH · Aspects of Statistical Inference
 WESTFALL and YOUNG · Resampling-Based Multiple Testing: Examples and Methods for p -Value Adjustment

*Now available in a lower priced paperback edition in the Wiley Classics Library.

WHITTAKER · Graphical Models in Applied Multivariate Statistics
WINKER · Optimization Heuristics in Economics: Applications of Threshold Accepting
WONNACOTT and WONNACOTT · Econometrics, *Second Edition*
WOODING · Planning Pharmaceutical Clinical Trials: Basic Statistical Principles
WOOLSON and CLARKE · Statistical Methods for the Analysis of Biomedical Data,
Second Edition
WU and HAMADA · Experiments: Planning, Analysis, and Parameter Design
Optimization
YANG · The Construction Theory of Denumerable Markov Processes
*ZELLNER · An Introduction to Bayesian Inference in Econometrics
ZHOU, OBUCHOWSKI, and McCLISH · Statistical Methods in Diagnostic Medicine