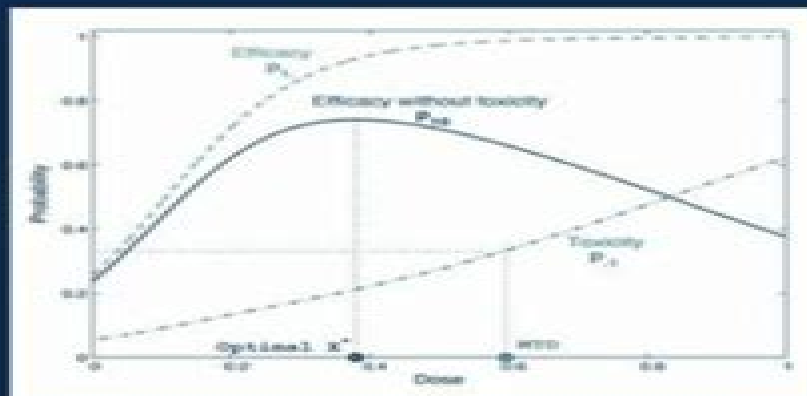


# Optimal Design for Nonlinear Response Models



**Valerii V. Fedorov**  
**Sergei L. Leonov**



**CRC Press**  
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# Optimal Design For Nonlinear Response Models

## Chapman Hallcrc Biostatistics Series

**Martijn P.F. Berger, Weng-Kee Wong**



## **Optimal Design For Nonlinear Response Models Chapman Hallcrc Biostatistics Series:**

*Mixed Effects Models for the Population Approach* Marc Lavielle, 2014-07-14 Wide Ranging Coverage of Parametric Modeling in Linear and Nonlinear Mixed Effects Models Mixed Effects Models for the Population Approach Models Tasks Methods and Tools presents a rigorous framework for describing implementing and using mixed effects models With these models readers can perform parameter estimation and modeling across a whole population of individuals at the same time Easy to Use Techniques and Tools for Real World Data Modeling The book first shows how the framework allows model representation for different data types including continuous categorical count and time to event data This leads to the use of generic methods such as the stochastic approximation of the EM algorithm SAEM for modeling these diverse data types The book also covers other essential methods including Markov chain Monte Carlo MCMC and importance sampling techniques The author uses publicly available software tools to illustrate modeling tasks Methods are implemented in Monolix and models are visually explored using Mlxplre and simulated using Simulx Careful Balance of Mathematical Representation and Practical Implementation This book takes readers through the whole modeling process from defining creating a parametric model to performing tasks on the model using various mathematical methods Statisticians and mathematicians will appreciate the rigorous representation of the models and theoretical properties of the methods while modelers will welcome the practical capabilities of the tools The book is also useful for training and teaching in any field where population modeling occurs

*Statistical Methods in Drug Combination Studies* Wei Zhao, Harry Yang, 2014-12-19 The growing interest in using combination drugs to treat various complex diseases has spawned the development of many novel statistical methodologies The theoretical development coupled with advances in statistical computing makes it possible to apply these emerging statistical methods in in vitro and in vivo drug combination assessments However

*Design and Analysis of Simulation Experiments* Jack P.C. Kleijnen, 2015-07-01 This is a new edition of Kleijnen s advanced expository book on statistical methods for the Design and Analysis of Simulation Experiments DASE Altogether this new edition has approximately 50% new material not in the original book More specifically the author has made significant changes to the book s organization including placing the chapter on Screening Designs immediately after the chapters on Classic Designs and reversing the order of the chapters on Simulation Optimization and Kriging Metamodels The latter two chapters reflect how active the research has been in these areas The validation section has been moved into the chapter on Classic Assumptions versus Simulation Practice and the chapter on Screening now has a section on selecting the number of replications in sequential bifurcation through Wald s sequential probability ratio test as well as a section on sequential bifurcation for multiple types of simulation responses Whereas all references in the original edition were placed at the end of the book in this edition references are placed at the end of each chapter From Reviews of the First Edition Jack Kleijnen has once again produced a cutting edge approach to the design and analysis of simulation experiments William E BILES JASA June 2009 Vol 104 No 486

*Optimal Design for Nonlinear Response Models* Valerii V. Fedorov, Sergei L. Leonov, 2013-07-15 *Optimal Design for Nonlinear Response Models* discusses the theory and applications of model based experimental design with a strong emphasis on biopharmaceutical studies. The book draws on the authors' many years of experience in academia and the pharmaceutical industry. While the focus is on nonlinear models, the book begins with an explanation of the key ideas using linear models as examples. Applying the linearization in the parameter space, it then covers nonlinear models and locally optimal designs as well as minimax optimal on average and Bayesian designs. The authors also discuss adaptive designs focusing on procedures with non-informative stopping. The common goals of experimental design such as reducing costs, supporting efficient decision making, and gaining maximum information under various constraints are often the same across diverse applied areas. Ethical and regulatory aspects play a much more prominent role in biological, medical, and pharmaceutical research. The authors address all of these issues through many examples in the book. **Platform Trial**

**Designs in Drug Development** Zoran Antonijevic, Robert A. Beckman, 2018-12-07 Platform trials test multiple therapies in one indication, one therapy for multiple indications, or both. These novel clinical trial designs can dramatically increase the cost effectiveness of drug development, leading to life-altering medicines for people suffering from serious illnesses, possibly at lower cost. Currently, the cost of drug development is unsustainable. Furthermore, there are particular problems in rare diseases and small biomarker-defined subsets in oncology where the required sample sizes for traditional clinical trial designs may not be feasible. The editors recruited the key innovators in this domain. The 20 articles discuss trial designs from perspectives as diverse as quantum computing, patient's rights to information, and international health. The book begins with an overview of platform trials from multiple perspectives. It then describes impacts of platform trials on the pharmaceutical industry's key stakeholders: patients, regulators, and payers. Next, it provides advanced statistical methods that address multiple aspects of platform trials, before concluding with a pharmaceutical executive's perspective on platform trials. Except for the statistical methods section, only a basic qualitative knowledge of clinical trials is needed to appreciate the important concepts and novel ideas presented. *An Introduction to Optimal Designs for Social and Biomedical Research* Martijn P.F. Berger, Weng-Kee Wong, 2009-05-27 The increasing cost of research means that scientists are in more urgent need of optimal design theory to increase the efficiency of parameter estimators and the statistical power of their tests. The objectives of a good design are to provide interpretable and accurate inference at minimal costs. Optimal design theory can help to identify a design with maximum power and maximum information for a statistical model and at the same time enable researchers to check on the model assumptions. This book introduces optimal experimental design in an accessible format. Provides guidelines for practitioners to increase the efficiency of their designs and demonstrates how optimal designs can reduce a study's costs. Discusses the merits of optimal designs and compares them with commonly used designs. Takes the reader from simple linear regression models to advanced designs for multiple linear regression and nonlinear models in a systematic

manner Illustrates design techniques with practical examples from social and biomedical research to enhance the reader's understanding Researchers and students studying social behavioural and biomedical sciences will find this book useful for understanding design issues and in putting optimal design ideas to practice *Exposure-Response Modeling* Jixian Wang, 2015-07-17 Discover the Latest Statistical Approaches for Modeling Exposure Response Relationships Written by an applied statistician with extensive practical experience in drug development this book explores a wide range of topics in exposure response modeling from traditional PKPD modeling to other areas in drug development and beyond It incorporates numerous examples and software programs for implementing novel methods The book emphasizes dose adjustment and treatment adaptation based on dynamic exposure response models illustrates how to apply causal inference to exposure response modeling in pharmacometrics and epidemiology and links exposure response modeling to clinical decision making through model based decision analysis *Handbook of Methods for Designing, Monitoring, and Analyzing Dose-Finding Trials* John O'Quigley, Alexia Iasonos, Björn Bornkamp, 2017-04-27 *Handbook of Methods for Designing Monitoring and Analyzing Dose Finding Trials* gives a thorough presentation of state of the art methods for early phase clinical trials The methodology of clinical trials has advanced greatly over the last 20 years and arguably nowhere greater than that of early phase studies The need to accelerate drug development in a rapidly evolving context of targeted therapies immunotherapy combination treatments and complex group structures has provided the stimulus to these advances Typically we deal with very small samples sequential methods that need to be efficient while at the same time adhering to ethical principles due to the involvement of human subjects Statistical inference is difficult since the standard techniques of maximum likelihood do not usually apply as a result of model misspecification and parameter estimates lying on the boundary of the parameter space Bayesian methods play an important part in overcoming these difficulties but nonetheless require special consideration in this particular context The purpose of this handbook is to provide an expanded summary of the field as it stands and also through discussion provide insights into the thinking of leaders in the field as to the potential developments of the years ahead With this goal in mind we present An introduction to the field for graduate students and novices A basis for more established researchers from which to build A collection of material for an advanced course in early phase clinical trials A comprehensive guide to available methodology for practicing statisticians on the design and analysis of dose finding experiments An extensive guide for the multiple comparison and modeling MCP Mod dose finding approach adaptive two stage designs for dose finding as well as dose time response models and multiple testing in the context of confirmatory dose finding studies John O'Quigley is a professor of mathematics and research director at the French National Institute for Health and Medical Research based at the Faculty of Mathematics University Pierre and Marie Curie in Paris France He is author of *Proportional Hazards Regression* and has published extensively in the field of dose finding Alexia Iasonos is an associate attending biostatistician at the Memorial Sloan Kettering Cancer Center in New York She has over one hundred publications

in the leading statistical and clinical journals on the methodology and design of early phase clinical trials Dr Iasonos has wide experience in the actual implementation of model based early phase trials and has given courses in scientific meetings internationally Björn Bornkamp is a statistical methodologist at Novartis in Basel Switzerland researching and implementing dose finding designs in Phase II clinical trials He is one of the co developers of the MCP Mod methodology for dose finding and main author of the DoseFinding R package He has published numerous papers on dose finding nonlinear models and Bayesian statistics and in 2013 won the Royal Statistical Society award for statistical excellence in the pharmaceutical industry

**Dose-Exposure-Response Modeling** Jixian Wang, 2026-02-19 This thoroughly revised and updated new edition reflects the progress that has been made in dose exposure response DER modeling As the title suggests the new edition covers more topics on dose and dose adjustment A large part of the book has been rewritten including an updated Bayesian analysis and modeling chapter with new materials on approximate Bayesian modeling with misspecified models Bayesian bootstrap for the cut the feedback approach and meta regression with Stan codes for implementation Two new chapters in this edition include one on causal DER modeling with an introduction to the concept of causal DER relationship approaches such as the generalized propensity score and instrumental control function approaches for adjustment for observed and unobserved confounders and Bayesian causal DER modeling Another new chapter is dedicated to learning DER relationships with the concept and methods of machine learning including applications to adaptive dose finding trials by bandits contextual bandits and Thompson sampling with Bayesian bootstrap adaptive control for tracking using a dynamic model with an application for individual warfarin dosing The new appendix contains non standard materials used in the book Applied statisticians and modelers can find details on how to implement new approaches while researchers can find topics for or applications of their work In addition students can see how complicated methodology and models are applied to practical situations

**Key Features** Provides SAS R and Stan codes that will enable readers to test the approaches in their own scenarios Gives a systematic treatment of concepts and methodology Helps with understanding concepts and evaluating the performance of new methods particularly those in Chapters 7 8 and 9 Includes a large amount of R codes for methods introduced in the new materials in chapters on Bayesian analyses causal inference and dose adjustment Includes a simulation to show how some complex methods such as generalized propensity score adjustment and adaptive dose adjustment can be implemented with simple codes

**Statistical Design, Monitoring, and Analysis of Clinical Trials** Weichung Joe Shih, Joseph Aisner, 2021-10-25 Statistical Design Monitoring and Analysis of Clinical Trials Second Edition concentrates on the biostatistics component of clinical trials This new edition is updated throughout and includes five new chapters Developed from the authors courses taught to public health and medical students residents and fellows during the past 20 years the text shows how biostatistics in clinical trials is an integration of many fundamental scientific principles and statistical methods The book begins with ethical and safety principles core trial design concepts the principles and methods

of sample size and power calculation and analysis of covariance and stratified analysis It then focuses on sequential designs and methods for two stage Phase II cancer trials to Phase III group sequential trials covering monitoring safety futility and efficacy The authors also discuss the development of sample size reestimation and adaptive group sequential procedures phase 2 3 seamless design and trials with predictive biomarkers exploit multiple testing procedures and explain the concept of estimand intercurrent events and different missing data processes and describe how to analyze incomplete data by proper multiple imputations This text reflects the academic research commercial development and public health aspects of clinical trials It gives students and practitioners a multidisciplinary understanding of the concepts and techniques involved in designing monitoring and analyzing various types of trials The book s balanced set of homework assignments and in class exercises are appropriate for students and researchers in bio statistics epidemiology medicine pharmacy and public health

Nonlinear Models for Repeated Measurement Data Marie Davidian,David .M. Giltinan,2017-11-01 Nonlinear measurement data arise in a wide variety of biological and biomedical applications such as longitudinal clinical trials studies of drug kinetics and growth and the analysis of assay and laboratory data Nonlinear Models for Repeated Measurement Data provides the first unified development of methods and models for data of this type with a detailed treatment of inference for the nonlinear mixed effects and its extensions A particular strength of the book is the inclusion of several detailed case studies from the areas of population pharmacokinetics and pharmacodynamics immunoassay and bioassay development and the analysis of growth curves

Adaptive Design Theory and Implementation Using SAS and R, Second Edition Mark Chang,2014-12-01 Get Up to Speed on Many Types of Adaptive Designs Since the publication of the first edition there have been remarkable advances in the methodology and application of adaptive trials Incorporating many of these new developments Adaptive Design Theory and Implementation Using SAS and R Second Edition offers a detailed framework to understand the use of various adaptive design methods in clinical trials New to the Second Edition Twelve new chapters covering blinded and semi blinded sample size reestimation design pick the winners design biomarker informed adaptive design Bayesian designs adaptive multiregional trial design SAS and R for group sequential design and much more More analytical methods for K stage adaptive designs multiple endpoint adaptive design survival modeling and adaptive treatment switching New material on sequential parallel designs with rerandomization and the skeleton approach in adaptive dose escalation trials Twenty new SAS macros and R functions Enhanced end of chapter problems that give readers hands on practice addressing issues encountered in designing real life adaptive trials Covering even more adaptive designs this book provides biostatisticians clinical scientists and regulatory reviewers with up to date details on this innovative area in pharmaceutical research and development Practitioners will be able to improve the efficiency of their trial design thereby reducing the time and cost of drug development

**Adaptive Design Theory and Implementation Using SAS and R** Mark Chang,2012-10-09 Adaptive design has become an important tool in modern pharmaceutical research and development

Compared to a classic trial design with static features an adaptive design allows for the modification of the characteristics of ongoing trials based on cumulative information Adaptive designs increase the probability of success reduce costs and the t

Adaptive Design Methods in Clinical Trials Shein-Chung Chow, Mark Chang, 2011-12-01 With new statistical and scientific issues arising in adaptive clinical trial design including the U S FDA s recent draft guidance a new edition of one of the first books on the topic is needed Adaptive Design Methods in Clinical Trials Second Edition reflects recent developments and regulatory positions on the use of adaptive designs in clini

Stefanie Biedermann, Holger Dette, David C. Woods, 2010

### **Optimal Design for Additive Partially Nonlinear Models**

Lenhart, John T. Workman, 2007-05-07 From economics and business to the biological sciences to physics and engineering

professionals successfully use the powerful mathematical tool of optimal control to make management and strategy decisions Optimal Control Applied to Biological Models thoroughly develops the mathematical aspects of optimal control theory and provides insight into the application of this theory to biological models Focusing on mathematical concepts the book first examines the most basic problem for continuous time ordinary differential equations ODEs before discussing more complicated problems such as variations of the initial conditions imposed bounds on the control multiple states and controls linear dependence on the control and free terminal time In addition the authors introduce the optimal control of discrete systems and of partial differential equations PDEs Featuring a user friendly interface the book contains fourteen interactive sections of various applications including immunology and epidemic disease models management decisions in harvesting and resource allocation models It also develops the underlying numerical methods of the applications and includes the MATLAB codes on which the applications are based Requiring only basic knowledge of multivariable calculus simple ODEs and mathematical models this text shows how to adjust controls in biological systems in order to achieve proper outcomes

**Applied Optimal Designs** Martijn P.F. Berger, Weng-Kee Wong, 2005-03-11 There is an increasing need to rein in the cost of scientific study without sacrificing accuracy in statistical inference Optimal design is the judicious allocation of resources to achieve the objectives of studies using minimal cost via careful statistical planning Researchers and practitioners in various fields of applied science are now beginning to recognize the advantages and potential of optimal experimental design Applied Optimal Designs is the first book to catalogue the application of optimal design to real problems documenting its widespread use across disciplines as diverse as drug development education and ground water modelling Includes contributions covering Bayesian design for measuring cerebral blood flow Optimal designs for biological models Computer adaptive testing Ground water modelling Epidemiological studies and pharmacological models Applied Optimal Designs bridges the gap between theory and practice drawing together a selection of incisive articles from reputed collaborators Broad in scope and inter disciplinary in appeal this book highlights the variety of opportunities available through the use of optimal design The wide range of applications presented here should appeal to statisticians working with



optimal designs and to practitioners new to the theory and concepts involved      Nonlinear Models for Repeated Measurement Data Marie Davidian,1998      **mODa 11 - Advances in Model-Oriented Design and Analysis** Joachim Kunert,Christine H. Müller,Anthony C. Atkinson,2016-06-06 This volume contains pioneering contributions to both the theory and practice of optimal experimental design Topics include the optimality of designs in linear and nonlinear models as well as designs for correlated observations and for sequential experimentation There is an emphasis on applications to medicine in particular to the design of clinical trials Scientists from Europe the US Asia Australia and Africa contributed to this volume of papers from the 11th Workshop on Model Oriented Design and Analysis      **Statistical Methods in Drug Combination Studies** Wei Zhao,Harry Yang,2014-12-19 The growing interest in using combination drugs to treat various complex diseases has spawned the development of many novel statistical methodologies The theoretical development coupled with advances in statistical computing makes it possible to apply these emerging statistical methods in in vitro and in vivo drug combination assessments Howeve

## Reviewing **Optimal Design For Nonlinear Response Models Chapman Hallcrc Biostatistics Series**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is truly astonishing. Within the pages of "**Optimal Design For Nonlinear Response Models Chapman Hallcrc Biostatistics Series**," an enthralling opus penned by a highly acclaimed wordsmith, readers attempt an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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