

Springer Series in Statistics

Thomas J. Santner  
Brian J. Williams  
William I. Notz

# The Design and Analysis of Computer Experiments

*Second Edition*



Springer

# The Design And Analysis Of Computer Experiments

## Springer Series In Statistics

**Nam-Ho Kim**



## **The Design And Analysis Of Computer Experiments Springer Series In Statistics:**

**The Design and Analysis of Computer Experiments** Thomas J. Santner, Brian J. Williams, William I. Notz, 2019-01-08

This book describes methods for designing and analyzing experiments that are conducted using a computer code a computer experiment and when possible a physical experiment Computer experiments continue to increase in popularity as surrogates for and adjuncts to physical experiments Since the publication of the first edition there have been many methodological advances and software developments to implement these new methodologies The computer experiments literature has emphasized the construction of algorithms for various data analysis tasks design construction prediction sensitivity analysis calibration among others and the development of web based repositories of designs for immediate application While it is written at a level that is accessible to readers with Masters level training in Statistics the book is written in sufficient detail to be useful for practitioners and researchers New to this revised and expanded edition An expanded presentation of basic material on computer experiments and Gaussian processes with additional simulations and examples A new comparison of plug in prediction methodologies for real valued simulator output An enlarged discussion of space filling designs including Latin Hypercube designs LHDs near orthogonal designs and nonrectangular regions A chapter length description of process based designs for optimization to improve good overall fit quantile estimation and Pareto optimization A new chapter describing graphical and numerical sensitivity analysis tools Substantial new material on calibration based prediction and inference for calibration parameters Lists of software that can be used to fit models discussed in the book to aid practitioners

**The Design and Analysis of Computer Experiments** Thomas J. Santner, Brian J. Williams, William I. Notz, 2014-01-15

**All of Statistics** Larry Wasserman, 2004-09-17 This book is for people who want to learn probability and statistics quickly It brings together many of the main ideas in modern statistics in one place The book is suitable for students and researchers in statistics computer science data mining and machine learning This book covers a much wider range of topics than a typical introductory text on mathematical statistics It includes modern topics like nonparametric curve estimation bootstrapping and classification topics that are usually relegated to follow up courses The reader is assumed to know calculus and a little linear algebra No previous knowledge of probability and statistics is required The text can be used at the advanced undergraduate and graduate level Larry Wasserman is Professor of Statistics at Carnegie Mellon University He is also a member of the Center for Automated Learning and Discovery in the School of Computer Science His research areas include nonparametric inference asymptotic theory causality and applications to astrophysics bioinformatics and genetics He is the 1999 winner of the Committee of Presidents of Statistical Societies Presidents Award and the 2002 winner of the Centre de recherches mathématiques de Montreal Statistical Society of Canada Prize in Statistics He is Associate Editor of The Journal of the American Statistical Association and The Annals of Statistics He is a fellow of the American Statistical Association and of the Institute of Mathematical Statistics     *The Oxford Handbook of Applied Bayesian Analysis* Anthony O'

Hagan, Mike West, 2010-03-18 Bayesian analysis has developed rapidly in applications in the last two decades and research in Bayesian methods remains dynamic and fast growing Dramatic advances in modelling concepts and computational technologies now enable routine application of Bayesian analysis using increasingly realistic stochastic models and this drives the adoption of Bayesian approaches in many areas of science technology commerce and industry This Handbook explores contemporary Bayesian analysis across a variety of application areas Chapters written by leading exponents of applied Bayesian analysis showcase the scientific ease and natural application of Bayesian modelling and present solutions to real engaging societally important and demanding problems The chapters are grouped into five general areas Biomedical Industry Economics Environment Policy Political and Natural Engineering Sciences and Appendix material in each touches on key concepts models and techniques of the chapter that are also of broader pedagogic and applied interest **Surrogate**

**Modeling For High-frequency Design: Recent Advances** Slawomir Koziel, Anna Pietrenko-dabrowska, 2022-03-04

Contemporary high frequency engineering design heavily relies on full wave electromagnetic EM analysis This is primarily due to its versatility and ability to account for phenomena that are important from the point of view of system performance Unfortunately versatility comes at the price of a high computational cost of accurate evaluation Consequently utilization of simulation models in the design processes is challenging although highly desirable The aforementioned problems can be alleviated by means of surrogate modeling techniques the most popular of which are data driven models Although a large variety of methods are available they are all affected by the curse of dimensionality This is especially pronounced in high frequency electronics where typical system responses are highly nonlinear Construction of practically useful surrogates covering wide ranges of parameters and operating conditions is a considerable challenge Surrogate Modeling for High Frequency Design presents a selection of works representing recent advancements in surrogate modeling and their applications to high frequency design Some chapters provide a review of specific topics such as neural network modeling of microwave components while others describe recent attempts to improve existing modeling methodologies Furthermore the book features numerous applications of surrogate modeling methodologies to design optimization and uncertainty

quantification of antenna microwave and analog RF circuits *Response Surface Methodology* Raymond H. Myers, Douglas C. Montgomery, Christine M. Anderson-Cook, 2011-09-20 Praise for the Second Edition This book is for anyone who would like a good solid understanding of response surface methodology The book is easy to read easy to understand and very applicable The examples are excellent and facilitate learning of the concepts and methods Journal of Quality Technology Complete with updates that capture the important advances in the field of experimental design Response Surface Methodology Third Edition successfully provides a basic foundation for understanding and implementing response surface methodology RSM in modern applications The book continues to outline the essential statistical experimental design fundamentals regression modeling techniques and elementary optimization methods that are needed to fit a response surface model from experimental data

With its wealth of new examples and use of the most up to date software packages this book serves as a complete and modern introduction to RSM and its uses across scientific and industrial research This new edition maintains its accessible approach to RSM with coverage of classical and modern response surface designs Numerous new developments in RSM are also treated in full including optimal designs for RSM robust design methods for design evaluation and experiments with restrictions on randomization as well as the expanded integration of these concepts into computer software Additional features of the Third Edition include Inclusion of split plot designs in discussion of two level factorial designs two level fractional factorial designs steepest ascent and second order models A new section on the Hoke design for second order response surfaces New material on experiments with computer models Updated optimization techniques useful in RSM including multiple responses Thorough treatment of presented examples and experiments using JMP 7 Design Expert Version 7 and SAS software packages Revised and new exercises at the end of each chapter An extensive references section directing the reader to the most current RSM research Assuming only a fundamental background in statistical models and matrix algebra Response Surface Methodology Third Edition is an ideal book for statistics engineering and physical sciences courses at the upper undergraduate and graduate levels It is also a valuable reference for applied statisticians and practicing engineers

**Engineering Design via Surrogate Modelling** Alexander Forrester, András Sobester, Andy Keane, 2008-09-15 Surrogate models expedite the search for promising designs by standing in for expensive design evaluations or simulations They provide a global model of some metric of a design such as weight aerodynamic drag cost etc which can then be optimized efficiently Engineering Design via Surrogate Modelling is a self contained guide to surrogate models and their use in engineering design The fundamentals of building selecting validating searching and refining a surrogate are presented in a manner accessible to novices in the field Figures are used liberally to explain the key concepts and clearly show the differences between the various techniques as well as to emphasize the intuitive nature of the conceptual and mathematical reasoning behind them More advanced and recent concepts are each presented in stand alone chapters allowing the reader to concentrate on material pertinent to their current design problem and concepts are clearly demonstrated using simple design problems This collection of advanced concepts visualization constraint handling coping with noisy data gradient enhanced modelling multi fidelity analysis and multiple objectives represents an invaluable reference manual for engineers and researchers active in the area Engineering Design via Surrogate Modelling is complemented by a suite of Matlab codes allowing the reader to apply all the techniques presented to their own design problems By applying statistical modelling to engineering design this book bridges the wide gap between the engineering and statistics communities It will appeal to postgraduates and researchers across the academic engineering design community as well as practising design engineers Provides an inclusive and practical guide to using surrogates in engineering design Presents the fundamentals of building selecting validating searching and refining a surrogate model

Guides the reader through the practical implementation of a surrogate based design process using a set of case studies from real engineering design challenges Accompanied by a companion website featuring Matlab software at <http://www.wiley.com/go/forrester>

**Reliability and Optimization of Structural Systems** Daniel Straub, 2010-07-28 This volume contains 28 papers by renowned international experts on the latest advances in structural reliability methods and applications engineering risk analysis and decision making new optimization techniques and various applications in civil engineering Moreover several contributions focus on the assessment and optimization of existing str

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Proceedings of the ... ASME Design Engineering Technical Conferences, 2006

AMSTAT News American Statistical Association, 2006

Surrogate Modeling and Optimization Nam-Ho Kim, 2026-01-05 An expert reference on building surrogate models using them for optimization their associated prediction uncertainty and potential failures with practical implementation in MATLAB

Surrogate Modeling and Optimization explains the meaning of different surrogate models and provides an in depth understanding of such surrogates emphasizing how much uncertainty is associated with them and when and how a surrogate model can fail in approximating complex functions helping readers understand theory through practical implementation in MATLAB This book enables readers to obtain an accurate approximate function using as few samples as possible thereby allowing them to replace expensive computer simulations and experiments during design optimization sensitivity analysis and or uncertainty quantification The book is organized into three parts Part I introduces the basics of surrogate modeling Part II reviews various theories and algorithms of design optimization Part III presents advanced topics in surrogate modeling including the Kriging surrogate neural network models multi fidelity surrogates and efficient global optimization using Kriging surrogates Each chapter contains a multitude of examples and exercise problems Lecture slides and a solution manual for exercise problems are available for instructors on a companion website Topics discussed in Surrogate Modeling and Optimization include Various designs of experiments such as those developed for linear and quadratic polynomial response surfaces PRS in a boxlike design space Criteria for constrained and unconstrained optimization and the most important optimization theories Various numerical algorithms for gradient based optimization Gradient free optimization algorithms often referred to as global search algorithms which do not require gradient or Hessian information Detailed explanations and implementation on Kriging surrogates often referred to as Gaussian Process especially when samples include noise The combination of a small number of high fidelity samples with many low fidelity samples to improve prediction accuracy Neural network models focusing on training uncertainty and its effect on prediction uncertainty Efficient global optimization using either polynomial response surfaces or Kriging surrogates

Surrogate Modeling and Optimization is an essential learning companion for senior level undergraduate and graduate students in all engineering disciplines including mechanical aerospace civil biomedical and electrical engineering The book is also valuable for industrial

practitioners who apply surrogate models to solve their optimization problems      **Mathematical Reviews** ,2008      **AIAA Journal** American Institute of Aeronautics and Astronautics,2008      **Fighting the Curse of Dimensionality** Ryan Patrick Feeley,2008      Oil & Gas Science and Technology ,2007      **Design and Analysis of Experiments** Angela Dean,Daniel Voss,Danel Draguljić,2017-04-05 This book offers a step by step guide to the experimental planning process and the ensuing analysis of normally distributed data emphasizing the practical considerations governing the design of an experiment Data sets are taken from real experiments and sample SAS programs are included with each chapter Experimental design is an essential part of investigation and discovery in science this book will serve as a modern and comprehensive reference to the subject      **Actor-oriented Programming for Wireless Sensor Networks** Elaine Cheong,2007      **Proceedings of the ... Congress on Evolutionary Computation** ,2004      **Bayesian Treed Gaussian Process Models** Robert B. Gramacy,2005

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