1. Record Nr. UNINA9910144099003321

Autore	Forrester Alexander I. J.
Titolo	Engineering design via surrogate modelling : a practical guide / / Alexander I.J. Forrester, Andras Sobester, and Andy J. Keane, University of Southampton, UK
Pubbl/distr/stampa	Chichester, West Sussex, England : , : Wiley, , 2008 ©2008
ISBN	0-470-77080-5 1-281-84101-3 9786611841010 1-61583-477-X 0-470-77079-1 9780470770801 9780470770795 0470770791
Descrizione fisica	1 online resource (xviii, 210 pages) : illustrations (some colour)
Disciplina	620.0044 620/.0042015118
Soggetti	Engineering design - Mathematical models Engineering design - Statistical methods
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Engineering Design via Surrogate Modelling; Contents; Preface; About the Authors; Foreword; Prologue; Part I Fundamentals; 1 Sampling Plans; 1.1 The 'Curse of Dimensionality' and How to Avoid It; 1.2 Physical versus Computational Experiments; 1.3 Designing Preliminary Experiments (Screening); 1.3.1 Estimating the Distribution of Elementary Effects; 1.4 Designing a Sampling Plan; 1.4.1 Stratification; 1.4.2 Latin Squares and Random Latin Hypercubes; 1.4.3 Space-filling Latin Hypercubes; 1.4.4 Space-filling Subsets; 1.5 A Note on Harmonic Responses; 1.6 Some Pointers for Further Reading References2 Constructing a Surrogate; 2.1 The Modelling Process; 2.1.1 Stage One: Preparing the Data and Choosing a Modelling Approach;

2.1.2 Stage Two: Parameter Estimation and Training; 2.1.3 Stage Three: Model Testing; 2.2 Polynomial Models; 2.2.1 Example One: Aerofoil Drag; 2.2.2 Example Two: a Multimodal Testcase; 2.2.3 What About the k-variable Case?; 2.3 Radial Basis Function Models; 2.3.1 Fitting Noise-Free Data; 2.3.2 Radial Basis Function Models of Noisy Data; 2.4 Kriging; 2.4.1 Building the Kriging Model; 2.4.2 Kriging Prediction; 2.5 Support Vector Regression
2.5.1 The Support Vector Predictor2.5.2 The Kernel Trick; 2.5.3 Finding the Support Vectors; 2.5.4 Finding ; 2.5.5 Choosing C and ; 2.5.6 Computing : -SVR; 2.6 The Big(ger) Picture; References; 3 Exploring and Exploiting a Surrogate; 3.1 Searching the Surrogate; 3.2 Infill Criteria; 3.2.1 Prediction Based Exploitation; 3.2.2 Error Based Exploration; 3.2.3 Balanced Exploitation and Exploration; 3.2.4 Conditional Likelihood Approaches; 3.2.5 Other Methods; 3.3 Managing a Surrogate Based Optimization Process; 3.3.1 Which Surrogate for What Use?
3.3.2 How Many Sample Plan and Infill Points?3.3.3 Convergence Criteria; 3.4 Search of the Vibration Isolator Geometry Feasibility Using Kriging Goal Seeking; References; Part II Advanced Concepts; 4 Visualization; 4.1 Matrices of Contour Plots; 4.2 Nested Dimensions; Reference; 5 Constraints; 5.1 Satisfaction of Constraints by Construction; 5.2 Penalty Functions; 5.3 Example Constrained Problem; 5.3.1 Using a Kriging Model of the Constraint Function; 5.3.2 Using a Kriging Model of the Objective Function; 5.4 Expected Improvement Based Approaches
5.4.1 Expected Improvement With Simple Penalty Function5.4.2 Constrained Expected Improvement; 5.5 Missing Data; 5.5.1 Imputing Data for Infeasible Designs; 5.6 Design of a Helical Compression Spring Using Constrained Expected Improvement; 5.7 Summary; References; 6 Infill Criteria with Noisy Data; 6.1 Regressing Kriging; 6.2 Searching the Regression Model; 6.2.1 Re-Interpolation; 6.2.2 Re-Interpolation With Conditional Likelihood Approaches; 6.3 A Note on Matrix Ill-Conditioning; 6.4 Summary; References; 7 Exploiting Gradient Information; 7.1 Obtaining Gradients; 7.1.1 Finite Differencing
7.1.2 Complex Step Approximation

Sommario/riassunto

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