

1. Record Nr.	UNINA9910141601803321
Titolo	Multidisciplinary design optimization in computational mechanics [[electronic resource] /] / edited by Piotr Breitkopf, Rajan Filomeno Coelho
Pubbl/distr/stampa	London, : ISTE Hoboken, N.J., : Wiley, 2010
ISBN	1-118-60015-0 1-118-60002-9
Descrizione fisica	1 online resource (573 p.)
Collana	ISTE
Altri autori (Persone)	BreitkopfPiotr CoelhoRajan Filomeno
Disciplina	620.100285
Soggetti	Engineering design Engineering mathematics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Cover; Multidisciplinary Design Optimization in Computational Mechanics; Title Page; Copyright Page; Table of Contents; Foreword; Notes for Instructors; Acknowledgements; Chapter 1. Multilevel Multidisciplinary Optimization in Airplane Design; 1.1. Introduction; 1.2. Overview of the traditional airplane design process and expected MDO contributions; 1.3. First step toward MDO: local dimensioning by mathematical optimization; 1.4. Second step toward MDO: multilevel multidisciplinary dimensioning; 1.5. Elements of an MDO process; 1.6. Choice of optimizers; 1.6.1. Deterministic algorithms 1.6.2. Stochastic algorithms 1.7. Coupling between levels; 1.7.1. Reduction of mathematical models; 1.7.2. Simplified physical models; 1.8. Post-processing; 1.8.1. Lagrange multipliers; 1.8.2. Pareto fronts; 1.8.3. Self-organizing maps; 1.9. Conclusion; Chapter 2. Response Surface Methodology and Reduced Order Models; 2.1. Introduction; 2.2. Introducing some more notations; 2.3. Linear regression; 2.3.1. Introduction to linear regression; 2.3.2. Leverage; 2.3.3. Generalized linear regression; 2.3.4. An implicit reduced order model: moving least-squares (MLS) method

2.3.5. Bias-variance trade-off
2.4. Non-linear regression; 2.4.1. Neural networks as an example of non-linear models; 2.4.2. Another example of a non-linear model: parametrized RBFs; 2.4.3. Gradient algorithms; 2.4.4. Second-order methods; 2.5. Kriging interpolation; 2.5.1. Recall on Gaussian regression; 2.5.2. Basic principles of kriging algorithms; 2.5.3. Trend estimation; 2.5.4. Covariance estimation; 2.6. Non-parametric regression and kernel-based methods; 2.6.1. Introduction to non-parametric methods; 2.6.2. Parzen window regression; 2.6.3. Radial basis functions (RBFs)
2.6.4. EM estimation of a mixture
2.6.5. How RBFs are used in this book; 2.7. Support vector regression; 2.7.1. Variational formulation of SVR; 2.7.2. Dual formulation of SVR; 2.7.3. Computation of SVR models; 2.7.4. Self-reproducing Hilbert space; 2.7.5. Regularizing properties of the kernel; 2.7.6. Margin selection and -regression; 2.7.7. Large databases and recursive learning; 2.8. Model selection; 2.8.1. Estimating generalization error; 2.8.2. Cross-validation methods; 2.8.3. Leverage methods; 2.9. Introduction to design of computer experiments (DoCE); 2.9.1. Classical techniques
2.9.2. Input space sampling
2.9.3. Adaptive learning and sequential design; 2.10. Bibliography; Chapter 3. PDE Metamodeling using Principal Component Analysis; 3.1. Principal component analysis (PCA); 3.2. Truncation rank and projector error; 3.3. Application: POD reduction of velocity fields in an engine combustion chamber; 3.4. Reduced-basis methods, numerical analysis; 3.4.1. POD-Galerkin projection method; 3.4.2. Dual approach POD-Petrov-Galerkin; 3.5. Intrusive/non-intrusive aspects; 3.6. Double reduction in both space and parameter dimensions; 3.7. The weighted residual method
3.8. Non-linear problems

Sommario/riassunto

This book provides a comprehensive introduction to the mathematical and algorithmic methods for the Multidisciplinary Design Optimization (MDO) of complex mechanical systems such as aircraft or car engines. We have focused on the presentation of strategies efficiently and economically managing the different levels of complexity in coupled disciplines (e.g. structure, fluid, thermal, acoustics, etc.), ranging from Reduced Order Models (ROM) to full-scale Finite Element (FE) or Finite Volume (FV) simulations. Particular focus is given to the uncertainty quantification and its impact on the robust
