

1. Record Nr.	UNINA9910864198403321
Autore	Marti Kurt
Titolo	Stochastic Optimization Methods : Applications in Engineering and Operations Research
Pubbl/distr/stampa	Cham : , : Springer International Publishing AG, , 2024 ©2024
ISBN	9783031400599 9783031400582
Edizione	[4th ed.]
Descrizione fisica	1 online resource (389 pages)
Disciplina	519.62
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Intro -- Preface -- Contents -- 1 Stochastic Optimization Methods -- 1.1 Introduction -- 1.2 Deterministic Substitute Problems: Basic Formulation -- 1.2.1 Minimum or Bounded Expected Costs -- 1.2.2 Minimum or Bounded Maximum Costs (Worst Case) -- 1.3 Optimal Decision/Design Problems with Random Parameters -- 1.4 Deterministic Substitute Problems in Optimal Decision/Design -- 1.4.1 Expected Cost or Loss Functions -- 1.5 Basic Properties of Deterministic Substitute Problems -- 1.6 Approximations of Deterministic Substitute Problems in Optimal Design/Decision -- 1.6.1 Approximation of the Loss Function -- 1.6.2 Approximation of State (Performance) Functions -- 1.6.3 Taylor Expansion Methods -- 1.7 Approximation of Probabilities-Probability Inequalities -- 1.7.1 Bonferroni-Type Inequalities -- 1.7.2 Tschebyscheff-Type Inequalities -- References -- 2 Solution of Stochastic Linear Programs by Discretization Methods -- 2.1 A Priori Error Bounds -- 2.2 Discretization and Error Bounds -- 2.2.1 Special Representations of the Random Matrix ($T(\cdot)$, $h(\cdot)$) -- 2.3 Approximations of F with a Given Error Level -- 2.4 Norm Bounds for Optimal Solutions of (2.2a)-(2.2c) -- 2.5 Invariant Discretizations -- References -- 3 Optimal Control Under Stochastic Uncertainty -- 3.1 Stochastic Control Systems -- 3.1.1 Random Differential and Integral Equations -- 3.1.2 Objective Function -- 3.2 Control Laws -- 3.3 Convex Approximation by Inner

Linearization -- 3.4 Computation of Directional Derivatives -- 3.5 Canonical (Hamiltonian) System of Differential Equations/Two-Point Boundary Value Problem -- 3.6 Stationary Controls -- 3.7 Canonical (Hamiltonian) System of Differential -- 3.8 Computation of Expectations by Means of Taylor Expansions -- 3.8.1 Complete Taylor Expansion -- 3.8.2 Inner or Partial Taylor Expansion -- References.

4 Random Search Methods for Global Optimization-Basics -- 4.1 Introduction -- 4.2 The Convergence of the Basic Random Search Procedure -- 4.2.1 Discrete Optimization Problems -- 4.3 Adaptive Random Search Methods -- 4.3.1 Infinite-Stage Search Processes -- 4.4 Convex Problems -- References -- 5 Controlled Random Search Methods as a Stochastic Decision Process -- 5.1 The Controlled (or Adaptive) Random Search Method -- 5.1.1 The Convergence of the Controlled Random Search Procedure -- 5.1.2 A Stopping Rule -- 5.2 Computation of the Conditional Distribution of upper FF Given the Process History: Information Processing -- References -- 6 Applications to Random Search Methods with Joint Normal Search Variates -- 6.1 Introduction -- 6.2 Convergence of the Random Search Procedure (6.2) -- 6.3 Controlled Random Search Methods -- 6.4 Computation of Optimal Controls -- 6.5 Convergence Rates of Controlled Random Search Procedures -- 6.6 Numerical Realizations of Optimal Control Laws -- References -- 7 Random Search Methods with Multiple Search Points -- 7.1 Standard RSM -- 7.2 Multiple RSM -- 7.3 Probability of Failure, Probability of Success -- 7.3.1 Monotonicity of the Probability Functions p_f , p_s -- 7.3.2 Asymptotic Behavior in Case of i.i.d. Search Variables -- 7.3.3 Estimation of p_f and p_s in Case of Arbitrary Stochastically Independent Search Variables $Y_t, j=Y_j$ -- 7.4 Reachability Results Multiple RSM -- 7.5 Optimal Search Point Among Multiple Search Variables -- 7.5.1 The Optimized Search Process -- 7.5.2 Probability of Reaching B from the Outside -- References -- 8 Approximation of Feedback Control Systems -- 8.1 Introduction -- 8.2 Control Laws -- 8.3 Linear State-Feedback Control Systems -- 8.3.1 Taylor Expansion of the Feedback Control System with Respect to the Gain Matrix $G=(g_{ij})$ -- 8.3.2 Time-Dependent Gain Matrices. 8.4 Optimal Feedback Control Problem -- 8.4.1 Stepwise Optimization of $u_0(\cdot), G$ -- 8.5 Approximation of Nonlinear Feedback Control Systems -- 8.6 Approximation Error -- 8.7 Extensions -- 8.7.1 Special Representations of the Open-Loop (Prior) Control Function $u_0(\cdot)$ -- 8.7.2 Nonlinear Feedback Function -- References -- 9 Stochastic Optimal Open-Loop Feedback Control -- 9.1 Dynamic Structural Systems Under Stochastic Uncertainty -- 9.1.1 Stochastic Optimal Structural Control: Active Control -- 9.1.2 Stochastic Optimal Design of Regulators -- 9.1.3 Robust (Optimal) Open-Loop Feedback Control -- 9.1.4 Stochastic Optimal Open-Loop Feedback Control -- 9.2 Expected Total Cost Function -- 9.3 Open-Loop Control Problem on the Remaining Time Interval $[t_b, t_f]$ -- 9.4 The Stochastic Hamiltonian of (9.7a)-(9.7d) -- 9.4.1 Expected Hamiltonian (with Respect to the Time Interval $[t_b, t_f]$ and Information $\mathcal{H}(t_b)$) -- 9.4.2 H-Minimal Control on $[t_b, t_f]$ -- 9.5 Canonical (Hamiltonian) System -- 9.6 Minimum-Energy Control -- 9.6.1 Endpoint Control -- 9.6.2 Endpoint Control with Different Cost Functions -- 9.6.3 Weighted Quadratic Terminal Costs -- 9.7 Nonzero Costs for Displacements -- 9.7.1 Quadratic Control and Terminal Costs -- 9.8 Stochastic Weight Matrix $Q=Q(t, \cdot)$ -- 9.9 Uniformly Bounded Sets of Controls $D_t, t_0 \leq t \leq t_f$ -- 9.10 Approximate Solution of the Two-Point Boundary Value Problem (BVP) -- 9.10.1 Approximate Solution of the Fixed Point Eq. (9.75) -- 9.11 Example -- References -- 10 Adaptive Optimal Stochastic Trajectory Planning and Control (AOSTPC) -- 10.1 Introduction -- 10.2

Optimal Trajectory Planning for Robots -- 10.3 Problem Transformation -- 10.3.1 Transformation of the Dynamic Equation -- 10.3.2 Transformation of the Control Constraints -- 10.3.3 Transformation of the State Constraints -- 10.3.4 Transformation of the Objective Function.

10.4 OSTP-Optimal Stochastic Trajectory Planning -- 10.4.1 Computational Aspects -- 10.4.2 Optimal Reference Trajectory, Optimal Feedforward Control -- 10.5 AOSTP-Adaptive Optimal Stochastic Trajectory Planning -- 10.5.1 (OSTP)-Transformation -- 10.5.2 The Reference Variational Problem -- 10.5.3 Numerical Solutions of (OSTP) in Real-Time -- 10.6 Online Control Corrections: PD-Controller -- 10.6.1 Basic Properties of the Embedding $q(t,)$ -- 10.6.2 The First-Order Differential dq -- 10.6.3 The Second-Order Differential d^2q -- 10.6.4 Third and Higher Order Differentials -- 10.7 Online Control Corrections: PID Controllers -- 10.7.1 Basic Properties of the Embedding $q(t,)$ -- 10.7.2 Taylor Expansion with Respect to ϵ -- 10.7.3 The First-Order Differential dq -- References -- 11 Machine Learning Under Stochastic Uncertainty -- 11.1 Foundations -- 11.2 Stochastic Optimization Methods in Machine Learning -- 11.2.1 Least Squares Estimation of the Parameter Vector -- 11.3 Estimation with Sublinear Loss Function $q=q(z)$ -- 11.3.1 Representation by a Stochastic Linear Optimization Problem (SLOP) -- 11.3.2 Numerical Solution of the (SLOP) -- 11.3.3 Two-Stage Stochastic Linear Programs (SLP) -- 11.4 Two and Multiple Group Classification Under Stochastic Uncertainty -- 11.4.1 Two Classes ($J=2, L=1$) -- 11.5 Multi-classification -- 11.5.1 Reduction of a Multi-classifier to Several Two-Class Classifiers -- References -- 12 Stochastic Structural Optimization with Quadratic Loss Functions -- 12.1 Introduction -- 12.2 State and Cost Functions -- 12.2.1 Cost Functions -- 12.3 Minimum Expected Quadratic Costs -- 12.4 Deterministic Substitute Problems -- 12.4.1 Weight (Volume)-Minimization Subject to Expected Cost Constraints -- 12.4.2 Minimum Expected Total Costs -- 12.5 Stochastic Nonlinear Programming -- 12.5.1 Symmetric, Non-uniform Yield Stresses. 12.5.2 Non Symmetric Yield Stresses -- 12.6 Reliability Analysis -- 12.7 Numerical Example: 12-Bar Truss -- 12.7.1 Numerical Results: MEC -- 12.7.2 Numerical Results: ECBO -- References -- 13 Maximum Entropy Techniques -- 13.1 Uncertainty Functions Based on Decision Problems -- 13.1.1 Optimal Decisions Based on the Two-Stage Hypothesis Finding (Estimation) and Decision-Making Procedure -- 13.1.2 Stability/Instability Properties -- 13.2 The Generalized Inaccuracy Function $H(,)$ -- 13.2.1 Special Loss Sets V -- 13.2.2 Representation of $H(,)$ and $H(,)$ by Means of Lagrange Duality -- 13.3 Generalized Divergence and Generalized Minimum Discrimination Information -- 13.3.1 Generalized Divergence -- 13.3.2 I-, J-Projections -- 13.3.3 Minimum Discrimination Information -- References -- Index.
