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| MT-531 | Stochastic Optimisation and Control |
| | <p><u>Search Techniques:</u> Introduction to direct random search, Monte Carlo methods, Nonlinear simplex (Nelder-Mead) algorithms, Recursive methods for linear systems, Recursive least squares (RLS), Least mean squares (LMS), Connection to Kalman filtering.</p> <p><u>Stochastic Approximation for Linear and Nonlinear Systems:</u> Root-finding and gradient-based stochastic approximation (Robbins-Monro), Gradient-free stochastic approximation, Finite-difference (FDSA) and simultaneous perturbation (SPSA) methods.</p> <p><u>Model Building:</u> Issues particular to Monte Carlo simulation models, Bias-variance tradeoff, Selecting "best" model via cross-validation, Fisher information matrix as summary measure.</p> <p><u>Simulation-Based Optimization:</u> Monte Carlo simulations to real-world system performance, Gradient-based methods (infinitesimal perturbation analysis and likelihood ratio), Non-gradient-based methods (FDSA, SPSA, etc.), Common random numbers.</p> <p><u>Markov Chain Monte Carlo (MCMC):</u> MCMC methods for difficult calculations, Metropolis-Hastings and Gibbs sampling, Applications to numerical integration and statistical estimation.</p> <p><u>Reference Books:</u></p> <ol style="list-style-type: none"> 1. Yin G and Zhang Q, <i>Stochastic Processes, Optimization, and Control Theory, Applications in Financial Engineering, Queuing Networks, and Manufacturing Systems</i>, Springer, 2006. 2. Spall J.C, <i>Introduction to Stochastic Search and Optimization: Estimation, Simulation and Control</i>, John Wiley & Sons, 2003. 3. Giordano F.R, <i>Mathematical Modelling</i>, 3rd Edition, Thomson, 2003. |