

1. Record Nr.	UNINA9911020053003321
Titolo	Bayesian approach to inverse problems [[electronic resource] /] / edited by Jerome Idier
Pubbl/distr/stampa	London, : ISTE Hoboken, NJ, : John Wiley, c2008
ISBN	1-282-16506-2 9786612165061 0-470-61119-7 0-470-39382-3
Descrizione fisica	1 online resource (383 p.)
Collana	Digital signal and image processing series. ; ; v.35
Altri autori (Persone)	IdierJerome
Disciplina	515/.357 519.542
Soggetti	Inverse problems (Differential equations) Bayesian statistical decision theory
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	Bayesian Approach to Inverse Problems; Table of Contents; Introduction; Part I. Fundamental Problems and Tools; Chapter 1. Inverse Problems, Ill-posed Problems; 1.1. Introduction; 1.2. Basic example; 1.3. Ill-posed problem; 1.3.1. Case of discrete data; 1.3.2. Continuous case; 1.4. Generalized inversion; 1.4.1. Pseudo-solutions; 1.4.2. Generalized solutions; 1.4.3. Example; 1.5. Discretization and conditioning; 1.6. Conclusion; 1.7. Bibliography; Chapter 2. Main Approaches to the Regularization of Ill-posed Problems; 2.1. Regularization; 2.1.1. Dimensionality control 2.1.1.1. Truncated singular value decomposition 2.1.1.2. Change of discretization; 2.1.1.3. Iterative methods; 2.1.2. Minimization of a composite criterion; 2.1.2.1. Euclidian distances; 2.1.2.2. Roughness measures; 2.1.2.3. Non-quadratic penalization; 2.1.2.4. Kullback pseudo-distance; 2.2. Criterion descent methods; 2.2.1. Criterion minimization for inversion; 2.2.2. The quadratic case; 2.2.2.1. Non-iterative techniques; 2.2.2.2. Iterative techniques; 2.2.3. The convex case; 2.2.4. General case; 2.3. Choice of regularization coefficient;

2.3.1. Residual error energy control
 2.3.2. "L-curve" method
 2.3.3. Cross-validation; 2.4. Bibliography;
 Chapter 3. Inversion within the Probabilistic Framework; 3.1. Inversion and inference; 3.2. Statistical inference; 3.2.1. Noise law and direct distribution for data; 3.2.2. Maximum likelihood estimation; 3.3. Bayesian approach to inversion; 3.4. Links with deterministic methods; 3.5. Choice of hyperparameters; 3.6. A priori model; 3.7. Choice of criteria; 3.8. The linear, Gaussian case; 3.8.1. Statistical properties of the solution; 3.8.2. Calculation of marginal likelihood; 3.8.3. Wiener filtering; 3.9. Bibliography
 Part II. Deconvolution
 Chapter 4. Inverse Filtering and Other Linear Methods; 4.1. Introduction; 4.2. Continuous-time deconvolution; 4.2.1. Inverse filtering; 4.2.2. Wiener filtering; 4.3. Discretization of the problem; 4.3.1. Choice of a quadrature method; 4.3.2. Structure of observation matrix H; 4.3.3. Usual boundary conditions; 4.3.4. Problem conditioning; 4.3.4.1. Case of the circulant matrix; 4.3.4.2. Case of the Toeplitz matrix; 4.3.4.3. Opposition between resolution and conditioning; 4.3.5. Generalized inversion; 4.4. Batch deconvolution; 4.4.1. Preliminary choices
 4.4.2. Matrix form of the estimate
 4.4.3. Hunt's method (periodic boundary hypothesis); 4.4.4. Exact inversion methods in the stationary case; 4.4.5. Case of non-stationary signals; 4.4.6. Results and discussion on examples; 4.4.6.1. Compromise between bias and variance in 1D deconvolution; 4.4.6.2. Results for 2D processing; 4.5. Recursive deconvolution; 4.5.1. Kalman filtering; 4.5.2. Degenerate state model and recursive least squares; 4.5.3. Autoregressive state model; 4.5.3.1. Initialization; 4.5.3.2. Criterion minimized by Kalman smoother; 4.5.3.3. Example of result
 4.5.4. Fast Kalman filtering

Sommario/riassunto

Many scientific, medical or engineering problems raise the issue of recovering some physical quantities from indirect measurements; for instance, detecting or quantifying flaws or cracks within a material from acoustic or electromagnetic measurements at its surface is an essential problem of non-destructive evaluation. The concept of inverse problems precisely originates from the idea of inverting the laws of physics to recover a quantity of interest from measurable data. Unfortunately, most inverse problems are ill-posed, which means that precise and stable solutions are not easy to devise
