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Regularization Of Inverse Problems Mathematics

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As will be shown, inverse problems typically lead to mathematical models that are not well-posed in the sense of Hadamard, i.e., to ill-posed problems. This means especially that their solution is unstable under data perturbations. Numerical methods that can cope with this problem are the so-called regularization methods.

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Regularization of Inverse Problems. These lecture notes for a graduate class present the regularization theory for linear and nonlinear ill-posed operator equations in Hilbert spaces.

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Regularization methods are a key tool in the solution of inverse problems. They are used to introduce prior knowledge and allow a robust approximation of ill-posed (pseudo-) inverses. In the last two decades interest has shifted from linear to nonlinear regularization methods, even for linear inverse problems.

Modern regularization methods for inverse problems | Acta ...

Many applications in industry and science require the solution of an inverse problem. To obtain a stable estimate of the solution of such problems, it is often necessary to implement a regularization strategy. In the first part of the present work, a multiplicative

Regularization methods for inverse problems

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In mathematics, statistics, and computer science, particularly in machine learning and inverse problems, regularization is the process of adding information in order to solve an ill-posed problem

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or to prevent overfitting. Regularization applies to objective functions in ill-posed optimization problems.

Regularization (mathematics) - Wikipedia

The investigation of regularization schemes with sparsity promoting penalty terms has been one of the dominant topics in the field of inverse problems over the last years, and Tikhonov functionals with l_p -penalty terms for $1 \leq p \leq 2$ have been studied extensively. The first investigations focused on regularization properties of the minimizers of such functionals with linear operators and on iteration schemes for approximating the minimizers.

Inverse Problems - IOPscience

A damped symplectic scheme, combined with the finite element method, is developed for the numerical implementation of SOAR, which yields a novel iterative regularization scheme for solving inverse source problems. Several numerical examples are given to show the accuracy and the acceleration effect of SOAR.

Second order asymptotical regularization methods for ...

An inverse problem in science is the process of calculating from a set of observations the causal factors that produced them: for example, calculating an image in X-ray computed tomography, source reconstruction in acoustics, or calculating the density of the Earth from measurements of its gravity field. It is called an inverse problem because it starts with the effects and then calculates the ...

Inverse problem - Wikipedia

Linear Inverse Problems and Tikhonov Regularization examines one such method: Tikhonov regularization for linear inverse problems defined on Hilbert spaces. This is a clear example of the power of applying deep mathematical theory to solve practical problems.

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Inverse problems aim at the determination of a cause x from observations y . Let the mathematical model $F : X \rightarrow Y$ describe the connection between the cause x and the observation y . The computation of $y \in Y$ from $x \in X$ forms the direct problem.

Regularization of Inverse Problems | SpringerLink

H.W. Engl, Regularization methods for the stable solution of inverse problems, Surveys on Mathematics for Industry, 3 (1993) 71–143 MathSciNet zbMATH Google Scholar H. W. Engl and H. Gfrerer, A posteriori parameter choice for general regularization methods for solving linear ill-posed problems, Appl. Numer.

Inverse problems and their regularization | SpringerLink

An inverse microtomography problem is under consideration in a class of functions with bounded V_H variation. An algorithm for solving this problem is proposed based on Tikhonov's regularization with a special regularizer. The algorithm ensures piecewise uniform convergence of approximate solutions to exact solution of the inverse problem.

Piecewise uniform regularization for the inverse problem ...

Inverse problems are typically ill-posed, which means that they are sensitive to noise, measurements errors, modelling errors, etc. This implies that, even if in theory an inverse problem has a unique solution, in practice this is not true, so a convergent algorithm might produce inappropriate results like high oscillations in a material ...

inverse problems - Regularization and Optimization ...

Book Description Tikhonov regularization is the most popular general-purpose method for regularization and uses much of the machinery of Hilbert space theory. This book develops the theory of Tikhonov regularization for linear inverse problems defined on Hilbert spaces and is ideal for graduates and researchers.

Linear Inverse Problems and Tikhonov Regularization (Carus ...

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