Inverse Modeling: An introduction to the theory and methods of inverse problems and data assimilation (IOP Expanding Physics)

Gen Nakamura, Roland Potthast

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This book provides a comprehensive introduction to the techniques, tools and methods for inverse problems and data assimilation. Inverse problems are widespread today in science and technology, and this book is written at the interface between mathematics and applications, designed for students, researchers and developers in mathematics, physics, engineering, acoustics, electromagnetics, meteorology, biology, environmental and other applied sciences.?

Basic analytic questions and tools are introduced, as well as a wide variety of concepts, methods and approaches to formulate and solve inverse problems, among others classical regularization and iterative methods, but also more recent approaches like sampling and probe methods, field reconstruction techniques in acoustics and electromagnetics and source reconstruction. In the framework of data assimilation, stochastic and deterministic methods are becoming more and more intertwined ? both variational and ensemble data assimilation methods are introduced, as well as stochastic and deterministic viewpoints and analysis. Applications range from neural kernel reconstruction to inverse acoustic and electromagnetic scattering and thermography, from magnetic tomography for fuel cells or in a medical environment to weather forecasting and earth science.? OCTAVE /MATLAB? codes are included, which serve as a first step towards simulations and more sophisticated inversion or data assimilation algorithms.

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