1. Record Nr. UNINA9910377829803321

Autore	Hristopulos Dionissios T.
Titolo	Random Fields for Spatial Data Modeling : A Primer for Scientists and Engineers / / by Dionissios T. Hristopulos
Pubbl/distr/stampa	Dordrecht : , : Springer Netherlands : , : Imprint : Springer, , 2020
ISBN	9789402419184 9402419187
Edizione	[1st ed. 2020.]
Descrizione fisica	1 online resource (XXX, 867 p. 622 illus., 134 illus. in color.)
Collana	Advances in Geographic Information Science, , 1867-2434
Disciplina	519.23
Soggetti	Sociophysics Econophysics Geophysics Statistics Applied mathematics Engineering mathematics Statistical physics Data-driven Science, Modeling and Theory Building Geophysics/Geodesy Statistics for Engineering, Physics, Computer Science, Chemistry and Earth Sciences Geophysics and Environmental Physics Mathematical and Computational Engineering Statistical Physics and Dynamical Systems
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Introduction -- Preliminary Remarks -- Why Random Fields? -- Notation and Definitions -- Noise and Errors -- Spatial Data and Basic Processing Procedures -- A Personal Selection of Relevant Books -- Trend Models and Estimation -- Empirical Trend Estimation -- Regression Analysis -- Global Trend Models -- Local Trend Models -- Trend Estimation based on Physical Information -- Trend Based on the Laplace Equation -- Basic Notions of Random Fields -- Introduction -- Single-Point Description -- Stationarity and Statistical Homogeneity --

Sommario/riassunto

This book provides an inter-disciplinary introduction to the theory of random fields and its applications. Spatial models and spatial data analysis are integral parts of many scientific and engineering

disciplines. Random fields provide a general theoretical framework for the development of spatial models and their applications in data analysis. The contents of the book include topics from classical statistics and random field theory (regression models, Gaussian random fields, stationarity, correlation functions) spatial statistics (variogram estimation, model inference, kriging-based prediction) and statistical physics (fractals, Ising model, simulated annealing, maximum entropy, functional integral representations, perturbation and variational methods). The book also explores links between random fields, Gaussian processes and neural networks used in machine learning. Connections with applied mathematics are highlighted by means of models based on stochastic partial differential equations. An interlude on autoregressive time series provides useful lower-dimensional analogies and a connection with the classical linear harmonic oscillator. Other chapters focus on non-Gaussian random fields and stochastic simulation methods. The book also presents results based on the author’s research on Spartan random fields that were inspired by statistical field theories originating in physics. The equivalence of the one-dimensional Spartan random field model with the classical, linear, damped harmonic oscillator driven by white noise is highlighted. Ideas with potentially significant computational gains for the processing of big spatial data are presented and discussed. The final chapter concludes with a description of the Karhunen-Loève expansion of the Spartan model. The book will appeal to engineers, physicists, and geoscientists whose research involves spatial models or spatial data analysis. Anyone with background in probability and statistics can read at least parts of the book. Some chapters will be easier to understand by readers familiar with differential equations and Fourier transforms.