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Titolo	Data Analysis for Direct Numerical Simulations of Turbulent Combustion : From Equation-Based Analysis to Machine Learning / / edited by Heinz Pitsch, Antonio Attili
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Disciplina	532.0527015118 532.0527
Soggetti	Mathematics - Data processing Fluid mechanics Mathematical physics Thermodynamics Computer science Ecology Computational Mathematics and Numerical Analysis Engineering Fluid Dynamics Theoretical, Mathematical and Computational Physics Computer Science Environmental Sciences
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Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references.
Nota di contenuto	Partial A-Posteriori LES of DNS Data of Turbulent Combustion -- Application of the Optimal Estimator Analysis to Turbulent Combustion Modeling -- Reduced Order Modeling of Rocket Combustion Flows -- Dynamic Mode Decompositions: A Tool to Extract Structure Hidden in Massive Dataset -- Analysis of Combustion-Modes Through Structural and Dynamic Technique -- Analysis of the Impact of Combustion On Turbulence: Triadic Analysis, Wavelets, Structure Functions, Spectra -- Analysis of Flame Topology and Burning Rates -- Dissipation Element Analysis of Turbulent Combustion -- Higher Order Tensors for DNS

Data Analysis and Compression -- Covariant Lyapunov Vector Analysis of Turbulent Reacting Flows -- CEMA Analysis Applied to DNS Data -- Combined Computational Singular Perturbation-Tangential Stretching Rate Diagnostics of Large -- Scale Simulations of Reactive Turbulent Flows: Feature Tracking, Time Scale Characterization, and Cause/Effect Identification -- Genetic Algorithms Applied to LES Model Development -- Sub-grid Scale Signal Reconstruction: From Discrete and Iterative Deconvolution Operators to Convolutional Neural Networks -- Machine Learning for Combustion Rate Shaping -- Machine Learning of Combustion LES Models from DNS -- Developing Artificial Neural Networks Based Models for Complex Turbulent Flow by Utilizing DNS Database.

Sommario/riassunto

This book presents methodologies for analysing large data sets produced by the direct numerical simulation (DNS) of turbulence and combustion. It describes the development of models that can be used to analyse large eddy simulations, and highlights both the most common techniques and newly emerging ones. The chapters, written by internationally respected experts, invite readers to consider DNS of turbulence and combustion from a formal, data-driven standpoint, rather than one led by experience and intuition. This perspective allows readers to recognise the shortcomings of existing models, with the ultimate goal of quantifying and reducing model-based uncertainty. In addition, recent advances in machine learning and statistical inferences offer new insights on the interpretation of DNS data. The book will especially benefit graduate-level students and researchers in mechanical and aerospace engineering, e.g. those with an interest in general fluid mechanics,applied mathematics, and the environmental and atmospheric sciences.