

1. Record Nr.	UNINA9910462820003321
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Titolo	Multiscale and multiresolution approaches in turbulence [[electronic resource] ] : LES, DES and Hybrid RANS/LES methods : applications and guidelines // Pierre Sagaut, Sebastien Deck, Marc Terracol
Pubbl/distr/stampa	London, : Imperial College Press Singapore, : Distributed by World Scientific, c2013
ISBN	1-84816-987-6
Edizione	[2nd ed.]
Descrizione fisica	1 online resource (448 p.)
Altri autori (Persone)	DeckSebastien TerracolMarc
Disciplina	531.1134 532.0527
Soggetti	Turbulence - Mathematical models Turbulence Electronic books.
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 (p. 397-423) and index.
Nota di contenuto	Foreword to the Second Edition; Foreword to the First Edition; Contents; 1. A Brief Introduction to Turbulence; 1.1 Common Features of Turbulent Flows; 1.1.1 Introductory concepts; 1.1.2 Randomness and coherent structure in turbulent flows; 1.2 Turbulent Scales and Complexity of a Turbulent Field; 1.2.1 Basic equations of turbulent flow; 1.2.2 Defining turbulent scales; 1.2.3 A glimpse at numerical simulations of turbulent flows; 1.3 Inter-scale Coupling in Turbulent Flows; 1.3.1 The energy cascade; 1.3.2 Inter-scale interactions; 2. Turbulence Simulation and Scale Separation 2.1 Numerical Simulation of Turbulent Flows 2.2 Reducing the Cost of the Simulations; 2.2.1 Scale separation; 2.2.2 Navier-Stokes-based equations for the resolved quantities; 2.2.3 Navier-Stokes-based equations for the unresolved quantities; 2.3 The Averaging Approach: Reynolds-Averaged Numerical Simulation (RANS); 2.3.1 Statistical average; 2.3.2 Reynolds-Averaged Navier-Stokes equations; 2.3.3 Phase-Averaged Navier-Stokes equations; 2.4 The Large-Eddy Simulation Approach (LES); 2.4.1 Large and small scales separation;

2.4.2 Filtered Navier-Stokes equations

2.5 Multilevel/Multiresolution solution Methods

2.5.1 Hierarchical multilevel decomposition; 2.5.2 Practical example: the multiscale/multilevel LES decomposition; 2.5.3 Associated Navier-Stokes-based equations; 2.5.4 Classification of existing multilevel methods; 2.5.4.1 Multilevel methods based on resolved-only wave numbers; 2.5.4.2 Multilevel methods based on higher wave numbers; 2.5.4.3 Adaptive multilevel methods; 2.6 Summary; 3. Statistical Multiscale Modelling; 3.1 General; 3.2 Exact Governing Equations for the Multiscale Problem; 3.2.1 Basic equations in physical and spectral space

3.2.2 The multiscale splitting; 3.2.3 Governing equations for band-integrated approaches; 3.3 Spectral Closures for Band-integrated Approaches; 3.3.1 Local versus non-local transfers; 3.3.2 Expression for the spectral fluxes; 3.3.3 Dynamic spectral splitting; 3.3.4 Turbulent diffusion terms; 3.3.5 Viscous dissipation term; 3.3.6 Pressure term; 3.4 A Few Multiscale Models for Band-integrated Approaches; 3.4.1 Multiscale Reynolds stress models; 3.4.2 Multiscale eddy viscosity models; 3.5 Spectral Closures for Local Approaches; 3.5.1 Local multiscale Reynolds stress models

3.5.1.1 Closures for the linear transfer term; 3.5.1.2 Closures for the linear pressure term; 3.5.1.3 Closures for the non-linear homogeneous transfer term; 3.5.1.4 Closures for the non-linear non-homogeneous transfer term; 3.5.2 Local multiscale eddy viscosity models; 3.6 Achievements and Open Issues; 4. Multiscale Subgrid Models: Self-adaptivity; 4.1 Fundamentals of Subgrid Modelling; 4.1.1 Functional and structural subgrid models; 4.1.2 The Gabor-Heisenberg curse; 4.2 Germano-type Dynamic Subgrid Models; 4.2.1 Germano identity; 4.2.1.1 Two-level multiplicative Germano identity; 4.2.1.2 Multilevel Germano identity

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Sommario/riassunto

The book aims to provide the reader with an updated general presentation of multiscale/multiresolution approaches in turbulent flow simulations. All modern approaches (LES, hybrid RANS/LES, DES, SAS) are discussed and recast in a global comprehensive framework. Both theoretical features and practical implementation details are addressed. Some full scale applications are described, to provide the reader with relevant guidelines to facilitate a future use of these methods.

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