# TABLE OF CONTENTS

Planar Richtmyer-Meshkov Instabilities and Transition to Turbulence ................................................................. 1  
Akshay Gowardhan, Fernando Grinstein, J. Ray Ristorcelli

Analysis of Computational and Laboratory Shocked Gas-Curtain Experiments ....................................................... 10  
A. Gowardhan, S. Balasubramanian, F. Grinstein, K. Prestridge, J. Ristorcelli

Characteristics of Unsteady Flows in Enclosed Chamber with an Obstacle Creating Vortex Separation .................. 19  
A. Nowakowski, F. Nicolleau, S. Salim

Commutation Error Mitigation in Variable-Resolution PANS Closure: Proof of Concept in Decaying Isotropic Turbulence ......................................................................................................................... 25  
Stefan Wallin, Sharath Girimaji

Performance Analysis of Partially-Averaged Navier-Stokes Method for Complex Turbulent Flows ......................... 41  
B. Basara, S. Krajnovic, Z. Pavlovic, P. Ringqvist

Partially Averaged Navier-Stokes Method: Modeling and Simulation of Low Reynolds Number Effects in Flow Past a Circular Cylinder ................................................................................................................. 51  
S. Lakshmipathy, D. Reyes, S. Girimaji

Embedded LES Using PANS ....................................................................................................................................... 71  
Lars Davidson, Shua-Hui Peng

PANS of Rudimentary Landing Gear .......................................................................................................................... 89  
S. Krajnovic, R. Larusson, E. Helgason, B. Basara

Stable and Efficient Galerkin Reduced Order Models for Non-Linear Fluid Flow .................................................. 106  
I. Kalashnikova, M. Barone

POD-based Reduced-order Model for Arbitrary Mach Number Flows ........................................................................ 132  
Kedar Pathak, Nail Yamaleev

The GNAT Nonlinear Model Reduction Method and its Application to Fluid Dynamics Problems ............................ 144  
K. Carlberg, J. Cortial, D. Amsallem, M. Zahr, C. Farhat

Projection-Based Model Reduction with Stability Guarantee .......................................................................................... 168  
David Amsallem, Charbel Farhat

A Model of Turbulent Dispersion Through Roughness Layer Using Centre Manifolds .............................................. 184  
Dmitry Strunin

Measurement of the Wake Behind a Bat-Like Flapper and the Influence of the Flapping Frequency on Lift Generation ........................................................................................................................................ 188  
C. Schunk, J. Bahlman, S. Swartz, K. Breuer

Bioinspired Aerostructural Design for In-flight MAV Collision Recovery ................................................................. 200  
R. Guiler, P. Wentworth, T. Vaneck

Flowfield Evolution vs. Lift Coefficient History for Rapidly-Pitching Low Aspect Ratio Plates ................................ 214  
K. Granlund, M. OL, L. Bernal

Tip Vorticity and Membrane-Strain Analysis on a MAV Elliptical Pliant Membrane-Wing ........................................ 234  
C. Ray, R. Albertani

An Experimental Investigation on the Wake Flow Characteristics of Tandem Flapping Wings ..................................... 245  
A. Kumar, H. Hu

Effects of Flexibility on the Aerodynamic Performance of Flapping Wings .............................................................. 262  
C. Kang, H. Aono, C. Cesnik, W. Shyy

Global Linear Instability at the Dawn of its 4th Decade: A List of Challenges (A Practical Guide on how to Contain the Euphoria and Avoid the Oversell) .................................................................................. 308  
V. Theofilis, S. Le Clainche

Nonlinear Response of a Laminar Boundary Layer to Isotropic and Spanwise Localized Free-stream Turbulence .............................................................................................................................................. 334  
Y. Zhang, T. Zaki, S. Sherwin, X. Wu

Nonlinear Receptivity and Instability Studies by Proper Orthogonal Decomposition ............................................... 373  
T. Sengupta, S. Bhaumik, Y. Bhumkar

Numerical Study of Boundary-layer Receptivity on a Swept Wing ............................................................................. 416  
David Tempelmann, Arideesh Hanifi, Luca Brandt, Dan Henningson

Stability of Periodic Oscillation Around the Trailing Edge of NACA0012 Airfoil ...................................................... 429  
Asei Tezuka

Stability Analysis of the Flow Around an Airfoil in Stalled Configuration ............................................................... 442  
S. Tsiloufas, R. Gioria, B. Carmo, J. Meneghini
The Top-Down Model of Wind Farm Boundary Layers and its Applications ......................................................... 450

Charles Meneveau

Offshore Marine Boundary-Layer Winds Predicted by a Large Eddy Simulation Model with Resolved Surface Waves ........................................................................................................................ 460

Peter Sullivan, Edward Patton

Wind Energy and the Turbulent Nature of the Atmospheric Boundary Layer ........................................................ 467

M. Wachtel, M. Holling, P. Milan, J. Peinke

Influences of Atmospheric Boundary Layer Turbulence Structure on the Space-time Variability in Wind Turbine Blade and Shaft Loadings ............................................................................. 478

Ganesh Vijayakumar, Adam Lavely, Michael Kinzel, Eric Paterson, James Brassier

Proper Orthogonal Decomposition of a Wind Turbine Array Boundary Layer .................................................. 482

Raul Cal, Max Gibson

 Modeling the Uncertainty in Farm Performance Introduced by the Ill-predictability of the Wind Resource ............................................................................................................................................. 488

Achille Messac, Souma Chowdhury, Jie Zhang

Boundary Layer Transition over Blunt Hypersonic Vehicles Including Effects of Ablation-Induced Out-Gassing .......................................................................................................................................... 507

Fei Li, Meelan Choudhari, Chau-Lyan Chang, Jeffery White

Recent Developments in Modeling Hypersonic Melting Ablation ........................................................................ 523

T. Zien

Hypersonics Simulations Based on the Regularized Grad Equations for Multicomponent Plasmas ...................... 555

Gerald Martin, Michael Kapper, Thierry Magin

Effects of Regular and Random Microstructures on Hypersonic Boundary Layers ................................................ 574

S. Stephen, V. Michael

Effects of Velocity Slip and Temperature Jump on the Boundary Layer Flow and Heat Transfer over a Wedge ......................................................................................................................... 585

J. Wang

Matrix Extraction Technique for Global Stability of Compressible Flows and Applications ............................. 603

Miguel Ángel Fosas de Pando, Peter Schmid

Simulation of Electrochemical MHD induced Flow in a Microfluidic Cell without Channels ............................. 612

D. Sen, K. Isaac, N. Leventis, I. Frisch

Verification and Validation at the Micro- and Nanoscale .......................................................................................... 622

A. Conlisk, M. Yoda

Challenges in Variable-Resolution Modeling of Turbulence: Fluctuating Flow-Field Physics and Characterization ............................................................................................................................................... 635

S. Lakshmipathy, S. Girimaji

Two-Point Turbulence Closures Applied to Variable Resolution Modeling ......................................................... 648

S. Girimaji, R. Rubinstein

Towards a Hybrid Temporal LES Method ............................................................................................................... 658

R. Meunec, C. Friess, T. Gatski

Smart Sub-Grid-Scale Models for LES and Hybrid RANS/LES .......................................................................... 674

P. Batten, U. Goldberg, E. Kang, S. Chakravarthy

Critical Evaluation of Some Popular Hybrid LES/RANS Methods by Reference to Flow Separation at a Curved Wall .............................................................................................................. 686

Suad Jakirlic, Chi-Yao Chang, Gisa Kadavelil, Bjoern Kniesner, Robert Maduta, Sanjin Saric

Scale-Resolving Simulation Techniques in Industrial CFD ..................................................................................... 708

F. Menter, J. Schütze, K. Kurabatski, M. Gritskevich, A. Garbaruk

Biologically Inspired Wing Leading Edge for Enhanced Wind Turbine and Aircraft Performance ............. 720

T. Swanson, K. Isaac

Numerical Validation and Modelling of Linearized Developing Flow in Channels and Tubes with Slip ............. 730

Y. Mazychka, R. Enright

Towards the Foundation of a Global Modes Concept .................................................................................................. 742

Daniel Rodriguez Alvarez, Anatoli Tumin

Global Instability of Helical Vortex Breakdown ..................................................................................................... 760

P. Meliga, F. Gallaire

Effect of Aspect Ratio on the Three-Dimensional Global Instability Analysis of Incompressible Open Cavity Flows .......................................................................................................................... 768

Fernando Meseguer, Javier de Vicente, Eusebio Valero, Vassilios Theofilis

Linear Global Instability of non-orthogonal Incompressible Swept Attachment-line Boundary Layer Flow ................................................................................................................................. 785

Jose Perez, Daniel Rodriguez, Vassilios Theofilis
Optimization and Control of a Separated Boundary-layer flow
Pierre-Yves Passaggia, Uwe Ehrenstein

Global Linear Stability of a Model Subsonic Jet
X. Garnaud, L. Lesshafft, P. Pruerr

Wind Turbines Research at Los Alamos National Laboratory -- Integrating Experimental Aerodynamics, Sensing, Structural Mechanics and Numerical Simulat
B. Balakumar, C. Ammerman, S. Pol, R. Linn, E. Ros, G. Ellis, G. Park, R. Farinholt, R. Alarcon

Preliminary Investigation of the Active Flow Control Benefits on Wind Turbine Blades
G. Wang, J. Walecak, B. Elhadidi, M. Glauser

Turbulence and the Isolated Wind Turbine

The Role of Large Scales of Turbulence in Wind Turbine Blades at Various Angles of Attack
S. Torres-Nieves, V. Maldonado, L. Castillo, C. Meneveau, H. Kang

Qualitative and Quantitative Description of a Wind Turbine Wake
L. Chamorro, M. Guila

Optimizing Energy Production From Vortex-Induced Vibrations Using Control Strategy Deduced From an Exact Nonlinear Asymptotic Model
J. Chomaz, P. Meliga, F. Gallaire

The Scenario of Two-Dimensional Instabilities of the Cylinder Wake Under EHD Forcing: A Linear Stability Analysis
J. D'Adamo, L. Gonzalez, A. Gronskis, G. Artana

Linear Instability of Orthogonal Compressible Leading-Edge Boundary Layer Flow
E. Gennaro, D. Rodriguez, M. Medeiros, V. Theofilis

The PSE-3D Instability Analysis Methodology for Flows Depending Strongly on Two and Weakly on the Third Spatial Dimension
Vassilios Theofilis, Daniel Rodriguez, J. Tendero

Coupling Time-stepping Numerical Methods and Standard Aerodynamics Codes for Instability Analysis of Flows in Complex Geometries
F. Gomez, R. Gomez, V. Theofilis

Wave-like Disturbances on the Downstream Wall of an Open Cavity
J. de Vicente, P. Paredes, E. Valero, V. Theofilis

Viscous and Inviscid Instabilities of Supersonic Flow in a Streamwise Corner
Oliver Schmidt, Ulrich Rist

Measurement of a Turbulent Vortex Pair using Time Resolved PIV
Vincent Brion, Laurent Jacquin

Excitation of Steady and Unsteady Gortler Vortices by Free-stream Vortical Disturbances
X. Wu, D. Zhao, J. Luo

Interaction Between Two-Dimensional Tollmien-Schlichting Waves and Vibrating Surfaces
Alicia Rothmayer, Wade Huesch

Stability of Separation Bubbles in a Channel Induced by a Suction Slot
J. Gajar, H. Zahed

Receptivity of High-Speed Boundary Layer To Solid Particulates
A. Fedorov, M. Kozlov

Stability of Unsteady Nonlinear Streaks Induced by Free-Stream Vortical Disturbances
P. Rico, J. Luo, X. Wu

Spatio-Temporal Development of the Pairing Instability in Helical Vortices
H. Bolhout, T. Leweke, S. Le Dizes

A Two-parameter Method for eN Transition Prediction
J. Van Ingen, M. Kotsonis

3D Dynamics and Turbulence Induced By Mountain and Inertia-Gravity Waves in the Upper Troposphere and Lower Stratosphere (UTLS)
A. Mahalov

On the Origin of the Log Law Region: Instantaneous Velocity Profile Models
D. Weyburne

Organised Motions in Turbulent Boundary Layers over a Wide Range of Reynolds Number
Kapil Chauhan, Ivan Marusic, Nick Hutchins

Effects of Outer Scales on the Peaks of Near-Wall Reynolds Stresses
M. Buschmann, M. Gad-el-Hak

RANS and LES of Turbulent Mixing in Confined Swirling and Non-Swirling Jets
Elizaveta Ivanova, Berthold Noll, Manfred Aigner

Optimal Control of Amplifier Flows using System Identification
Aurelien Herve, Denis Sipp, Peter Schmid, Manuel Samueldes