

8th AIAA Theoretical Fluid Mechanics Conference 2017

Held at the AIAA Aviation Forum 2017

Denver, Colorado, USA
5 – 9 June 2017

ISBN: 978-1-5108-4379-0

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

The contents of this work are copyrighted and additional reproduction in whole or in part are expressly prohibited without the prior written permission of the Publisher or copyright holder. The resale of the entire proceeding as received from CURRAN is permitted.

For reprint permission, please contact AIAA's Business Manager, Technical Papers. Contact by phone at 703-264-7500; fax at 703-264-7551 or by mail at 34922 Uwptkug'Xcmg{ 'F tkxg."Uwkug"422, Reston, VA 20191, USA.

TABLE OF CONTENTS

TFM-01: FLOW STABILITY AND TRANSITION

| | |
|---|----|
| NONLINEAR STABILITY OF THE COUETTE FLOW (AIAA 2017-3158) | 1 |
| <i>Pun Wong Yau, Shixiao Wang, Zvi Rusak</i> | |
| ACCOUNTING CROSSFLOW EFFECTS IN ONE-EQUATION LOCAL CORRELATION-BASED TRANSITION MODEL (AIAA 2017-3159) | 26 |
| <i>Subramanian Vallinayagam Pillai, Sylvain Lardeau</i> | |
| DYNAMIC MODE SHAPING FOR FLUID FLOW CONTROL: NEW STRATEGIES FOR TRANSIENT GROWTH SUPPRESSION (AIAA 2017-3160) | 39 |
| <i>Maziar Hemati, Huaijin Yao</i> | |
| REAL FLUID EFFECTS ON THERMOACOUSTIC STANDING-WAVE RESONANCE IN SUPERCritical CO ₂ (AIAA 2017-3161) | 55 |
| <i>Mario Tindaro Migliorino, Prateek Gupta, Carlo Scalo</i> | |
| NON-EQUILIBRIUM EFFECTS ON THE STABILITY OF A MACH 10 FLAT-PLATE BOUNDARY LAYER (AIAA 2017-3162) | 67 |
| <i>Xiaowen Wang</i> | |

TFM-02/APA-11: SUPERSONIC AND HYPERSONIC FLOWS

| | |
|---|-----|
| NUMERICAL SIMULATION OF JET IMPINGE ON TURBINE ROTOR OF THE LOITERING MUNITION (AIAA 2017-3345) | 91 |
| <i>Wen-Xiang Cai</i> | |
| A SHOCK WAVE FRONT MODEL APPLIED TO VERY THICK AND VERY THIN SUPERSONIC CONES AT ZERO INCIDENCE (AIAA 2017-3347) | 97 |
| <i>Ricardo T. Ferreyra</i> | |
| AN INVESTIGATION INTO HYPERSONIC INLET PERFORMANCE FOR A COUPLED INTERNAL/EXTERNAL SYSTEM AT OFF-DESIGN CONDITIONS (AIAA 2017-3348) | 106 |
| <i>Audrey S. Hall, Stephen M. Ruffin</i> | |
| EXPERIMENTAL STUDIES OF SUPERSONIC FLOW CHARACTERISTICS BETWEEN TWO WEDGES (AIAA 2017-3349) | 122 |
| <i>Mikhail Kotov, Larisa Ruleva, Sergey Solodovnikov</i> | |
| NUMERICAL INVESTIGATION OF RCS JET INTERACTION AND PLUME IMPINGEMENT FOR MARS PRECISION LANDING (AIAA 2017-3350) | 132 |
| <i>Raffaele Votta, Eduardo Trifoni, Giuseppe Pezzella, Marco Di Clemente, Antonio Schettino, Vincenzo Mareschi, Paolo Venditto, Federico Massobrio, Sanjay Vijendran, Jorge Alves, Luca Ferracina</i> | |

TFM-05: CFD AND THEORY

| | |
|---|-----|
| COMBINING A REDUCED POLYNOMIAL CHAOS EXPANSION APPROACH WITH UNIVERSAL KRIGING FOR UNCERTAINTY QUANTIFICATION (AIAA 2017-3481) | 153 |
| <i>Justin Weinmeister, Nelson Xie, Xinfeng Gao, Aditi Prasad, Sourajeet Roy</i> | |
| MODEL ORDER REDUCTION USING DMD MODES AND ADJOINT DMD MODES (AIAA 2017- 3482) | 168 |
| <i>Wei Zhang, Mingjun Wei</i> | |
| AN ENKF-BASED FLOW STATE ESTIMATOR FOR AERODYNAMIC FLOWS (AIAA 2017- 3483) | 178 |
| <i>Andre Fernando De Castro Da Silva, Tim Colonius</i> | |
| VALIDATION OF BEM USING CFD MRF COUPLED WITH AXIAL AND RADIAL INDUCTION FACTORS (AIAA 2017-3484) | 193 |
| <i>Niniva Dumakude, Maarten J. Kamper</i> | |
| VARIABLE INTERFACE DYNAMIC ADAPTATION (VIDA) TECHNIQUE: A NOVEL APPROACH TO ADJUST LAGRANGIAN FRAME AND EULERIAN FRAME AT FLATTERING INTERFACE (AIAA 2017-3485) | 200 |
| <i>Amir Zanj</i> | |

TFM-06: VORTEX DYNAMICS

| | |
|---|-----|
| SWIRLING FLOW STATES IN A FINITE-LENGTH STRAIGHT CIRCULAR PIPE (AIAA 2017-3677) | 207 |
| <i>Yuxin Zhang, Zvi Rusak, Shixiao Wang</i> | |
| THE CRITICAL STATE OF COMPRESSIBLE SWIRLING FLOWS (AIAA 2017-3678) | 240 |
| <i>Harry Lee, Zvi Rusak, Shixiao Wang</i> | |
| COMPRESSIBILITY EFFECT ON TOPOLOGY OF VORTEX RING FORMED BY VORTEX BREAKDOWN IN CLOSED CYLINDER AT LOW-MACH-NUMBERS (AIAA 2017-3679) | 262 |
| <i>Kento Yamada, Kojiro Suzuki</i> | |
| LEADING EDGE VORTEX SEPARATION STUDY BY DIFFERENT VORTEX AND FLOW SEPARATION IDENTIFICATION METHODS (AIAA 2017-3680) | 271 |
| <i>Yangzi Huang, Melissa A. Green</i> | |

TFM-07/APA-28: MULTI-PHASE FLOWS

| | |
|--|-----|
| WALL LUBRICATION FORCE MODELS FOR BUBBLY TWO-PHASE FLOW SIMULATION (AIAA 2017-3837) | 285 |
| <i>Xiaofeng Yang, Oshin Peroomian</i> | |

TFM-08: BOUNDARY LAYERS AND WAKES

| | |
|---|-----|
| NEAR CONTINUUM VELOCITY AND TEMPERATURE COUPLED BOUNDARY LAYER FLOW OVER A FLAT PLATE (AIAA 2017-4019) | 298 |
| <i>Xin He, Chunpei Cai</i> | |
| EFFECTS OF PARTIAL SLIP ON VISCOUS INSTABILITIES IN ROTATING-DISC BOUNDARY-LAYER FLOWS (AIAA 2017-4020) | 304 |
| <i>Sharon Stephen</i> | |
| ALTERNATIVE THREE-DIMENSIONAL INSTABILITY ANALYSIS OF THE WAKE OF A CIRCULAR CYLINDER (AIAA 2017-4021) | 314 |
| <i>Jose M. Perez, Soledad Le Clainche Martinez, José M. Vega</i> | |
| GENERATION OF CONVECTIVE INSTABILITY MODES IN THE NEAR-WAKE FLOW OF THE TRAILING EDGE OF A FLAT PLATE (AIAA 2017-4022) | 333 |
| <i>Ming Dong, Xuesong Wu</i> | |

TFM-09: SHOCK-BL INTERACTION

| | |
|---|-----|
| OPTIMAL SPATIAL GROWTH OF STREAKS IN OBLIQUE SHOCK/BOUNDARY LAYER INTERACTION (AIAA 2017-4163) | 386 |
| <i>Anubhav Dwivedi, Joseph W. Nichols, Mihailo R. Jovanovic, Graham V. Candler</i> | |

TFM-10: TURBULENCE MODELING AND THEORY

| | |
|--|-----|
| COMPRESSIBLE TURBULENT PLANE CHANNEL FLOW: DNS DATA AND OUTLOOK (AIAA 2017-4164) | 403 |
| <i>G. A. Gerolymos, Isabelle Vallet</i> | |
| FURTHER APPLICATIONS OF THE INTEGRAL FORMULA FOR DETERMINATION OF THE REYNOLDS STRESS IN TURBULENT FLOWS (AIAA 2017-4165) | 417 |
| <i>Tae-Woo Lee, Jung Eun Park</i> | |
| ROBUST BAYESIAN CALIBRATION OF A RANS MODEL FOR JET-IN-CROSSFLOW SIMULATIONS (AIAA 2017-4166) | 426 |
| <i>Jaideep Ray, Sophia Lefantzi, Srinivasan Arunajatesan, Lawrence J. Dechant</i> | |
| K-ϵ TURBULENCE MODEL PARAMETER ESTIMATES USING AN APPROXIMATE SELF-SIMILAR JET-IN-CROSSFLOW SOLUTION (AIAA 2017-4167) | 440 |
| <i>Lawrence J. Dechant, Jaideep Ray, Sophia Lefantzi, Julia Ling, Srinivasan Arunajatesan</i> | |
| DEVELOPMENT OF ADAPTIVE SUBGRID SCALE MODELS BASED ON A LARGE-SCALE VORTICITY SENSOR (AIAA 2017-4168) | 461 |
| <i>Jean-Baptiste Chapelier, Carlo Scalo, Bono Wasistho</i> | |

TFM-11: THEORETICAL AERODYNAMICS

| | |
|---|-----|
| THE STALL OF AIRFOILS WITH BLUNT NOSES AT LOW TO MODERATELY HIGH REYNOLDS NUMBERS (AIAA 2017-4337) | 479 |
| <i>Matthew Kraljic, Zvi Rusak</i> | |
| APPROXIMATE HESSIAN FOR ACCELERATED CONVERGENCE OF AERODYNAMIC SHAPE OPTIMIZATION PROBLEMS (AIAA 2017-4338) | 517 |
| <i>Doug Shi-Dong, Sivakumaran Nadarajah</i> | |
| NON-CIRCULATORY FLUID FORCES ON PANELS AND AIRFOILS WITH POROSITY GRADIENTS (AIAA 2017-4339)..... | 534 |
| <i>Rozhin Hajian, Justin Jaworski</i> | |
| TOWARDS A LOW-ORDER MODEL FOR TRANSONIC FLUTTER PREDICTION (AIAA 2017-4340)..... | 541 |
| <i>Max M. Opgenoord, Mark Drela, Karen E. Willcox</i> | |
| Author Index | |