

**Proceedings of
ASME 2021 Fluids Engineering Division
Summer Meeting
(FEDSM2021)**

Volume 1

**August 10-12, 2021
Virtual, Online**

**Conference Sponsor
Fluids Engineering Division**

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Two Park Avenue * New York, N.Y. 10016

© 2021, The American Society of Mechanical Engineers, 2 Park Avenue, New York, NY 10016, USA
(www.asme.org)

All rights reserved. Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.

INFORMATION CONTAINED IN THIS WORK HAS BEEN OBTAINED BY THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS FROM SOURCES BELIEVED TO BE RELIABLE. HOWEVER, NEITHER ASME NOR ITS AUTHORS OR EDITORS GUARANTEE THE ACCURACY OR COMPLETENESS OF ANY INFORMATION PUBLISHED IN THIS WORK. NEITHER ASME NOR ITS AUTHORS AND EDITORS SHALL BE RESPONSIBLE FOR ANY ERRORS, OMISSIONS, OR DAMAGES ARISING OUT OF THE USE OF THIS INFORMATION. THE WORK IS PUBLISHED WITH THE UNDERSTANDING THAT ASME AND ITS AUTHORS AND EDITORS ARE SUPPLYING INFORMATION BUT ARE NOT ATTEMPTING TO RENDER ENGINEERING OR OTHER PROFESSIONAL SERVICES. IF SUCH ENGINEERING OR PROFESSIONAL SERVICES ARE REQUIRED, THE ASSISTANCE OF AN APPROPRIATE PROFESSIONAL SHOULD BE SOUGHT.

ASME shall not be responsible for statements or opinions advanced in papers or . . . printed in its publications (B7.1.3). Statement from the Bylaws.

For authorization to photocopy material for internal or personal use under those circumstances not falling within the fair use provisions of the Copyright Act, contact the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923, tel: 978-750-8400, www.copyright.com.

Requests for special permission or bulk reproduction should be addressed to the ASME Publishing Department, or submitted online at: <https://www.asme.org/publications-submissions/journals/information-for-authors/journalguidelines/rights-and-permissions>

ISBN: 978-0-7918-8528-4

CONTENTS

Proceedings of ASME 2021 Fluids Engineering Division Summer Meeting Volume 1

AEROSPACE ENGINEERING DIVISION JOINT TRACK

Aerospace Engineering Division Joint Topic

FEDSM2021-61455	V001T01A001
Computational Study on Radiative Aerothermodynamics of a Reentry Space Vehicle <i>Qi Li and Sijun Zhang</i>	

COMPUTATIONAL FLUID DYNAMICS

Applied CFD

FEDSM2021-60958	V001T02A001
Parametric Study on Wing-Lambda-Shock Formation <i>Sirikorn Chainok, Thanapol Rungroch, Pattarasuda Chairach, Prasert Prapamonthon, Soemsak Yooyen, Bo Yin, Guowei Yang, and Shengjun Ju</i>	
FEDSM2021-61883	V001T02A002
Effect of Aerodynamic Moment on High-Speed Maglev Train Under Complicated Conditions <i>Zhanzhou Hao, Bo Yin, Guowei Yang, and Pan Xiao</i>	
FEDSM2021-65318	V001T02A003
Volume of Fluid Simulations of Copper Droplet Splat and Sensitivity to Modeling Methods <i>Laurie A. Florio</i>	
FEDSM2021-65585	V001T02A004
Effects of Aerodynamics on Line Sail During Parachute Deployment <i>Mingzhang Tang, Liwu Wang, Yu Liu, and Sijun Zhang</i>	
FEDSM2021-65600	V001T02A005
Shape Optimisation of NACA4412 In-Ground Effect- Selection of a Turbulence Model <i>Jithin P. N. and Ajith Kumar Arumugham-Achari</i>	
FEDSM2021-65624	V001T02A006
Numerical Investigating of Oscillatory Flow and Heat Transfer Through Stirling Regenerator <i>Houda Hachem, Ramla Gheith, and Fethi Aloui</i>	
FEDSM2021-65661	V001T02A007
3-D Computational Study of a Diffuser Augmented Micro Wind Turbine <i>Kiran M. S., Aakash Rajawat, and Pritanshu Ranjan</i>	
FEDSM2021-65771	V001T02A008
Computational Fluid Dynamic Analysis of the Flow Around a Propeller Blade of Multirotor Unmanned Aerodynamic Vehicle <i>Victor H. Martinez and Kiran Bhaganagar</i>	
FEDSM2021-65799	V001T02A009
Three-Dimensional Two-Phase Flow Simulations of Water Braking Phenomena for High-Speed Test Track Sled <i>Jose Terrazas, Arturo Rodriguez, Vinod Kumar, Richard Adansi, and V. M. Krishnarao Kotteda</i>	
FEDSM2021-65814	V001T02A010
Numerical Simulation of a Canadian Well With Several Circumferential Rows of Internal Vortex Generators <i>Nabil Kharoua, Hamza Semmari, Housseem Korichi, and Mehdi Haroun</i>	

FEDSM2021-65868	V001T02A011
Flow Characterization in the Upper Cavity of a Rotary Compressor <i>Puyuan Wu, Ang Li, Jun Chen, Paul E. Sojka, Yang Li, and Hongjun Cao</i>	
FEDSM2021-65877	V001T02A012
CFD Simulation of COVID Aerosol Dispersion in Indoor Environments <i>Mohammed Abushamleh and Ning Zhang</i>	
FEDSM2021-65886	V001T02A013
A Comprehensive Review of 4D Flow MRI and CFD in Cardiovascular and Congenital Heart Disease <i>Lamees El Nihum, Ponraj Chinnadurai, C. Huie Lin, and Debjyoti Banerjee</i>	
FEDSM2021-65991	V001T02A014
Viability of OpenFOAM as the Numerical Engine for Augmented Reality Sandbox <i>Elizabeth Smith</i>	
FEDSM2021-65996	V001T02A015
Aerodynamic Performance Evaluation of a Skydio UAV via CFD As a Platform for Bridge Girder Inspection: Phase 1 Study <i>Rodward L. Hewlin, Jr., Elizabeth Smith, Tara Cavalline, and Ali Karimoddini</i>	
FEDSM2021-66009	V001T02A016
Analysis of Aeroacoustic Generated From a Rotating Tire With a Longitudinal Groove Using Large-Eddy Simulation <i>Kengo Asada, Kimie Ito, Satoshi Sekimoto, Kozo Fujii, Masataka Koishi, and Toshiyuki Ikeda</i>	
CFD Development	
FEDSM2021-61454	V001T02A017
Minimum Wall Distance Computations With Time-Dependent Geometry for CFD <i>Liwu Wang, Jian Feng, Yu Liu, and Sijun Zhang</i>	
FEDSM2021-63196	V001T02A018
A High-Order Flux Reconstruction Method for 2-D Vorticity Transport <i>Adrin Gharakhani</i>	
FEDSM2021-65629	V001T02A019
Transient Rayleigh-Bénard Thermal Convection With Radiation Heat Transfer in Participating Media Using the Control Volume Finite Element Method (CVFEM) and Lattice Boltzmann Method <i>Raoudha Chaabane, Abdelmajid Jemni, and Fethi Aloui</i>	
FEDSM2021-65717	V001T02A020
An Improved Hybrid Alternative WENO Scheme for High Mach Number Flows <i>Uttam Singh Rajput and Krishna Mohan Singh</i>	
FEDSM2021-65920	V001T02A021
Progress in Analytical Modeling of Water Hammer <i>Kamil Urbanowicz, Haixiao Jing, Anton Bergant, Michał Stosiak, and Marek Lubecki</i>	
CFD Graduate Student Scholarship Competitions	
FEDSM2021-61832	V001T02A022
Effects of Wing Kinematics on Modulating Odor Plume Structures in the Odor Tracking Flight of Fruit Flies <i>Menglong Lei and Chengyu Li</i>	
FEDSM2021-65599	V001T02A023
An Improved Level-Set-Based Immersed Boundary Reconstruction Method for Computing Bio-Inspired Underwater Propulsion <i>Yu Pan, Haibo Dong, and Wei Zhang</i>	

FEDSM2021-65809	V001T02A024
An Investigation of the Effects of Volume Fraction on Drag Coefficient of Non-Spherical Particles Using PR-DNS <i>Pratik Mahyawansi and Cheng-Xian Lin</i>	
FEDSM2021-65823	V001T02A025
A New RANS Correction to Account for Varying Viscosity Effects <i>Victor Coppo Leite and Elia Merzari</i>	
FEDSM2021-65917	V001T02A026
Application of Scale-Resolving Simulations and Hybrid Models for Contraction-Expansion Pipe Flows <i>Farzin Darihaki, Jun Zhang, and Siamack A. Shirazi</i>	
FEDSM2021-65987	V001T02A027
Uncertainty Estimation in CFD Simulations of Erosion for Elbows <i>Elham Fallah Shojaie, Thiana A. Sedrez, Farzin Darihaki, and Siamack A. Shirazi</i>	
DNS, LES, and Hybrid-RANS/LES Methods	
FEDSM2021-65548	V001T02A028
Computational Modeling of Planing Hull Dynamics and Slamming in Head Waves <i>Konstantin I. Matveev</i>	
FEDSM2021-65808	V001T02A029
Assessment of Predictive Capability of Hybrid RANS/LES Turbulence Models for Thermofluid Applications <i>Anup Zope, Avery Schemmel, Xiao Wang, Shanti Bhushan, Prashant Singh, and Edward Luke</i>	
FEDSM2021-65916	V001T02A030
Statistically Targeted Forcing (STF) Method for Synthetic Turbulence Generation of Initial Conditions in Three-Dimensional Turbulent Mixing Layer Flow <i>Olalekan O. Shobayo and D. Keith Walters</i>	
Emerging Methods in CFD	
FEDSM2021-65506	V001T02A031
Three-Dimensional Weighted Multiple-Relaxation-Time Pseudopotential Lattice Boltzmann Method for Multiphase Flow <i>Jun Tang, Shengyuan Zhang, and Huiying Wu</i>	
FEDSM2021-65509	V001T02A032
A Three-Dimensional Phase Field Based Nonorthogonal Multiple-Relaxation-Time Lattice Boltzmann Method for Interface Tracking <i>Shengyuan Zhang, Jun Tang, and Huiying Wu</i>	
FEDSM2021-65621	V001T02A033
Solution-Responsive Particle Size Adaptivity in Lagrangian Vortex Particle Methods <i>Mark J. Stock and Adrin Gharakhani</i>	
FEDSM2021-65637	V001T02A034
A Hybrid High-Order Vorticity-Based Eulerian and Lagrangian Vortex Particle Method, the 2-D Case <i>Mark J. Stock and Adrin Gharakhani</i>	
FEDSM2021-65812	V001T02A035
Performing Fourier Transform on a Velocity Profile From Atmospheric Turbulence Studies <i>Richard Adansi, Jose Terrazas, Arturo Rodriguez, V. M. Krushnarao Kottedda, Vinod Kumar, Aldo Rubio, and Edgar Avalos</i>	

Fluid Structure Interaction (Including IBM)

- FEDSM2021-61453** V001T02A036
Wing Flutter Analysis Using Computational Fluid-Structure Interaction Dynamics
Jeremy A. Pohly, Mike R. Zhang, and Sijun Zhang
- FEDSM2021-64044** V001T02A037
Numerical Study of Fully Coupled Fluid-Structure Interaction of Stented Ureter by Varying the Stent Side-Holes
Erick Martinez, Ben Xu, Jianzhi Li, and Yingchen Yang
- FEDSM2021-65583** V001T02A038
Fluid-Structure Interaction Simulations of Parachute Deployment and Inflation
Liwu Wang, Mingzhang Tang, Yu Liu, and Sijun Zhang
- FEDSM2021-65790** V001T02A039
A Versatile IBM-Based AMR Method for Studying Human Snoring
Wei Zhang, Yu Pan, Yuchen Gong, Haibo Dong, and Jinxiang Xi
- FEDSM2021-65793** V001T02A040
Aerodynamic Performance of Design for a CO₂ Dragster
Brandon Paez, Arturo Rodriguez, Nicholas Dudu, Jose Terrazas, Richard Adansi, V. M. Krushnarao Kotteda, Julio C. Aguilar, and Vinod Kumar

Multi-Physics Simulation

- FEDSM2021-65102** V001T02A041
CFD Modeling of Blood Flow in a Bidirectional Glenn Shunt and a Combined Bidirectional Glenn and Blalock-Taussig Shunt
Chunhui Wang and Ramesh K. Agarwal
- FEDSM2021-65261** V001T02A042
Numerical Investigation of Supercritical *N*-Dodecane Flows in a Heated Circular Pipe With Thermal Cracking
Shuto Yatsuyanagi, Takashi Furusawa, Satoru Yamamoto, Takuo Onodera, and Sadatake Tomioka
- FEDSM2021-65695** V001T02A043
The CFD Analysis of Cavitation Erosion and Structural Optimization for an Unloading Valve
Kamal Upadhyay, Rui Yu, Hua Zhou, and Huayong Yang
- FEDSM2021-65792** V001T02A044
Computational Investigation of Thrust Production of a Dolphin at Various Swimming Speeds
Junshi Wang, Vadim Pavlov, Zhipeng Lou, and Haibo Dong
- FEDSM2021-66023** V001T02A045
Turbulent Flow Simulation of Supercritical Hydrothermal Synthesis in T-Shaped Channel
Takashi Furusawa, Kenta Matsui, Shuto Yatsuyanagi, Satoru Yamamoto, Akira Yoko, and Tadafumi Adschiri

Open Source CFD Applications

- FEDSM2021-61944** V001T02A046
Numerical Analysis on the Flow Bifurcation and Heat Transfer Regulation in the Constricted Cavity Under the Transverse Magnetic Field Using OpenFOAM
Ranjit J. Singh and Trushar B. Gohil
- FEDSM2021-65363** V001T02A047
Aeroacoustic Analysis of a UAV Propeller Operable at Various Altitudes
Ji-Hun Song, Seungsoo Jang, and Youn-Jea Kim
- FEDSM2021-65684** V001T02A048
Application of OpenFOAM in Numerical Simulations of High-Speed Trains Aerodynamics
Panpan Lu, Bo Yin, Guowei Yang, and Zhanling Ji

FEDSM2021-66406 **V001T02A049**
Harnessing the Power of the Cloud - Computational Fluid Dynamics With SimScale
Jousef Murad

Optimization, Data-Based Simulations, and Machine Learning

FEDSM2021-61843 **V001T02A050**
Causal Inference Analysis to Find Relationships Found in Boundary-Layer Transition – Part I:
Theoretical
*Arturo Rodriguez, Jose Terrazas, Richard Adansi, V. M. Krushnarao Kottedda, Jorge A. Munoz,
and Vinod Kumar*

FEDSM2021-65798 **V001T02A051**
Fractal and Convolutional Analysis for Deep Atmospheric Turbulence Using Machine Learning
*Nicholas Dudu, Arturo Rodriguez, Gael Moran, Jose Terrazas, Richard Adansi, V. M. Krushnarao
Kottedda, Christopher Harris, and Vinod Kumar*

FEDSM2021-65951 **V001T02A052**
Computational Analysis of Non-Premixed Combustion in a Scramjet Combustor With a Wedge
Shaped Strut Injector
Sajal Katare and Nagendra P. Yadav

FEDSM2021-66265 **V001T02A053**
Deep Learning Techniques for Effective Prediction of Aerodynamic Properties of Elliptical Bluff
Bodies
*W. M. U. Weerasekara, H. M. C. D. B. Gunarathna, W. A. K. P. Wanigasooriya, and
T. P. Miyanawala*

FEDSM2021-66282 **V001T02A054**
Prediction of Combustion Performance of Biodiesel in Gas Turbine Combustor
Priyanka Yadav and Nagendra P. Yadav