

Proceedings of the
**8TH ASME-JSME-KSME JOINT FLUIDS
ENGINEERING CONFERENCE
- 2019 -**

VOLUME 2
COMPUTATIONAL FLUID DYNAMICS

presented at
2019 8TH ASME-JSME-KSME JOINT FLUIDS ENGINEERING CONFERENCE
JULY 28-AUGUST 1, 2019
SAN FRANCISCO, CALIFORNIA, USA

sponsored by
FLUIDS ENGINEERING DIVISION, ASME

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Two Park Avenue * New York, NY. 10016

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.

Statement from By-Laws: The Society shall not be responsible for statements or opinions
Advanced in papers. . .or printed in its publications (7.1.3)

INFORMATION CONTAINED IN THIS WORK HAS BEEN OBTAINED BY ASME 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.

For authorization to photocopy material for internal or personal use under 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

Requests for special permission or bulk reproduction should be addressed to permissions@asme.org.

ISBN NO. 978-0-7918-5903-2

© 2019 ASME

All rights reserved.

Printed in U.S.A with permission by Curran Associates, Inc. (2020)

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

CONTENTS

COMPUTATIONAL FLUID DYNAMICS

APPLICATIONS OF CFD IN MEDICINE AND BIOMEDICAL SYSTEMS

AJKFluids2019-4689..... **V002T02A001**

Effects of Stenosis Geometry on Flow in Arteriovenous Fistula Patients

Jeff Krampf, Ramesh Agarwal, Surendra Shenoy

AJKFluids2019-4690..... **V002T02A002**

Shape Optimization of a Trumpet-Tipped LVAD Inflow Cannula to Reduce Blood Damage Using a Genetic Algorithm

Christopher J. Nassau, Ramesh K. Agarwal

AJKFluids2019-4771..... **V002T02A003**

CFD DEM Analysis of a Dry Powder Inhaler

Antara Badhan, V. M. Krushnarao Kotteda, Vinod Kumar

AJKFluids2019-4784..... **V002T02A004**

Numerical Simulation and Optimization of Blalock-Taussig Shunt

Thomas Hess, Ramesh Agarwal, David Hoganson

AJKFluids2019-5250..... **V002T02A005**

CFD Study of Implanted-Stent Impacts on Blood Flows in Left Coronary Artery Branch Models

Kazushi Fujimoto, Takahiro Tsukahara, Ken Yamamoto, Masahiro Motosuke, Hiroyoshi Kawamoto, Satoko Tahara, Kentaro Tanaka, Sunao Nakamura

APPLIED CFD

AJKFluids2019-4617..... **V002T02A006**

Effect of Microscopic Vortices Caused by Flow Interaction With Solid Obstacles on Heat Transfer in Turbulent Porous Media Flows

Ching-Wei Huang, Vishal Srikanth, Haodong Li, Andrey V. Kuznetsov

AJKFluids2019-4623..... **V002T02A007**

Numerical Simulation of Inline Arrangement of Spheroid Particles in Different Orientations

Abuzar Jamil, Emad Uddin, Ali Abbas Zaidi, Zaib Ali, Jawad Aslam, Syed Omer Gilani

AJKFluids2019-4654..... **V002T02A008**

A Study of Multiphase Flow and Heat Transfer in Proton Exchange Membrane Fuel Cells With Perforated Metal Gas Diffusion Layers

Torsten Berning, Shiro Tanaka

- AJKFluids2019-4669**..... **V002T02A009**
Impacts of Storm Surges on Hydrodynamics and Salinity of Sabine Lake and Sabine
River Diversion Canal
Hairui Wang, Ning Zhang
- AJKFluids2019-4691**..... **V002T02A010**
Theoretical and Numerical Studies on the Performance of Shock Vector Control
Kexin Wu, HeuyDong Kim
- AJKFluids2019-4713**..... **V002T02A011**
Comparison of a Singularity- and an Inverse Design Method for Axial Flow Fans
Based on Numerical Simulations
Anika Theis, Martin Bohle
- AJKFluids2019-4820**..... **V002T02A012**
A Numerical Analysis of the Hemodynamic Functionality of Human Coronary Stenosis
Under Different Physiologic Conditions and Boundary Condition Formulations
Iyad Fayssal, Fadl Moukalled
- AJKFluids2019-4881**..... **V002T02A013**
Computational Study of the Downpull Force on High-Head Slide Gates
*Juan C. Arango Escobar, David Calderon Villegas, Aldo Benavides Moran, Alejandro Molina
Ochoa*
- AJKFluids2019-4911**..... **V002T02A014**
Analysis of Angular Velocities, Surrounding Air Pressure and Velocities of Various
Designed Micro Vertical Axis Savonius Wind Turbines by the Computational Fluid
Dynamics (CFD) Method
W. Manosroi, T. Tangtrakool, C. Lhaosornthong
- AJKFluids2019-4912**..... **V002T02A015**
Numerical Investigation of Pressure Pulsation in Vaneless Region of a High Speed
Centrifugal Pump
Yongshun Zeng, Min Yang, Yuqing Zhai, Zhifeng Yao, Fujun Wang, Ruofu Xiao
- AJKFluids2019-4940**..... **V002T02A016**
Numerical Simulations of a Centrifugal Pump With a Non-Newtonian Fluid: Influence
on Performances of Different Rheological Modelling
*Matteo Occari, Valentina Mazzanti, Francesco Mollica, Enrico Munari, Michele Pinelli, Alessio
Suman*
- AJKFluids2019-4949**..... **V002T02A017**
A Computational Heat Transfer and Optimization Study of Drying of Peas and Rice in
a Rotary Dryer
Atinder Pal Singh, P. S. Ghoshdastidar

- AJKFluids2019-5033**..... **V002T02A018**
Numerical Investigation on Multiphase Reacting/Combusting Turbulent Flows:
Aerodynamics, Kinetics, Heat and Mass Transfer Inside a Cement Kiln Precalciner
Eugen-Dan Cristea, Pierangelo Conti
- AJKFluids2019-5063**..... **V002T02A019**
Numerical Simulation and Experiment of the Fire Protecting System of the
Manipulator in High Temperature Environment
Byeong Cheon Kim, Kyoungsik Chang
- AJKFluids2019-5137**..... **V002T02A020**
Computational Studies of Droplet Motion Near a Rough Surface via 3D Spectral
Boundary Elements
Yechun Wang, Xinnan Wang
- AJKFluids2019-5157**..... **V002T02A021**
Study of a Multistage Canned Motor Pump: Simulation, Optimization and Validation
Helmut Benigni, Markus Mosshammer, Helmut Jaberg
- AJKFluids2019-5173**..... **V002T02A022**
Numerical Prediction and Experimental Study on the Waviness Mechanical Seal
Xiaodong Feng, Yu Ma, Bin Huang
- AJKFluids2019-5239**..... **V002T02A023**
Numerical Analysis of Steady Blowing Based Active Flow Control for Flow Over
Ahmed Body
Bansal Shah, Debashis Basu
- AJKFluids2019-5284**..... **V002T02A024**
A Comprehensive Study of Asymmetric Micro-Droplet Splitting in T-Junction
Way Lee Cheng, Reza Sadr, Arum Han
- AJKFluids2019-5298**..... **V002T02A025**
Effect of Splitter Configurations on the Performance of a Sludge Pump
Jeong-Min Jin, Hyo-Geun Ji, Youn-Jea Kim
- AJKFluids2019-5299**..... **V002T02A026**
Optimal Design for Impeller of a Sludge Pump Using Design of Experiment
Jeong-Min Jin, Hyo-Geun Ji, Youn-Jea Kim
- AJKFluids2019-5383**..... **V002T02A027**
Three Dimensional Simulation of Ventilation Flow Through a Solar Windcatcher
Peter Abdo, Rahil Taghipour, B. P. Huynh
- AJKFluids2019-5385**..... **V002T02A028**
Three Dimensional Simulation of the Effect of Windcatcher's Inlet Shape
Peter Abdo, Rahil Taghipour, B. P. Huynh

AJKFluids2019-5414..... **V002T02A029**
Numerical Study of Heat Transfer in a Row of Cylinders by 2D Large Eddy Simulation
Andreas Stengaard Thorstensen, Andreas Krogh, Bjorn Christian Dueholm, Sebastian Baekkel Hojte, Signe Birkebaek Thomasen, Anna Lyhne Jensen, Henrik Sorensen, Jakob Haervig

AJKFluids2019-5419..... **V002T02A030**
A Numerical Investigation of Heat and Mass Transfer in Air-Cooled Proton Exchange Membrane Fuel Cells
Torsten Berning

AJKFluids2019-5564..... **V002T02A031**
Reynolds Averaged Navier-Stokes Simulation of Highly Turbulent, Under-Expanded Jets and Effects of Impingement at Elevated Injection Pressure
Jacob Riglin, Adam Wachtor, Robert Morgan, Ryan Holguin, John Bernardin

CFD DEVELOPMENT

AJKFluids2019-4981..... **V001T01A032**
A Validation Experiment for Turbulent Mixing in a Collated Jet
Ian G. R. Craig, Coleman D. Hoff, Paul J. Kristo, Mark L. Kimber

AJKFluids2019-5034..... **V002T02A032**
A Multi-Relaxation-Time Finite Volume Discrete Boltzmann Method for Viscous Flows
Leitao Chen, Hamid Sadat, Laura Schaefer

AJKFluids2019-5196..... **V002T02A033**
Numerical Simulation of Mixed Flow Past an Inclined Square Cylinder Using a Local Radial Basis Function Method
Tongsheng Wang, Zhu Huang, Zhongguo Sun, Guang Xi

AJKFluids2019-5483..... **V002T02A034**
Numerical and Experimental Study of Thermal Behavior of an Electric Fuse in Electric Vehicle Li-Ion Battery Packs
Gautam Pulugundla, Prahit Dubey

AJKFluids2019-5501..... **V002T02A035**
Turbulent Channel Flow With a Modified k- ω Turbulence Model for High-Order Finite Element Methods
Nojan Bagheri-Sadeghi, Brian T. Helenbrook, Kenneth D. Visser

COMPUTATIONAL MARINE HYDRODYNAMICS

AJKFluids2019-4619..... **V002T02A036**
Control of Air-Ventilated Cavity Under Ship Hull in Abnormal Waves
Konstantin I. Matveev

AJKFluids2019-4931..... **V002T02A037**
Hydrodynamic Performance and Appendage Considerations of Wave-Piercing
Planing Craft Overlapping Waves and Porpoising
Sang-Won Kim, Sang-Eui Lee, Gyoung-Woo Lee, Kwang-Cheol Seo, Nobuyuki Oshima

COMPUTATIONAL TURBULENT COMBUSTION

AJKFluids2019-4998..... **V002T02A038**
Thermo-Fluid Dynamic Design Exploration of a Double Pipe Heat Exchanger
Tomohiro Hirano, Mitsuo Yoshimura, Koji Shimoyama, Atsuki Komiya

AJKFluids2019-5075..... **V002T02A039**
Mechanism of Wall Turbulence Modulation With Premixed Hydrogen Combustion
Takashi Ohta, Yuta Onishi, Yasuyuki Sakai

EMERGING CFD TOPICS

AJKFluids2019-4675..... **V002T02A040**
Hydraulic Simulation for Calcasieu Lake Area With Small Rivers Using an Immersed
Boundary Method
Arun Yadav, Ning Zhang

AJKFluids2019-5281..... **V002T02A041**
Uncertainty Quantification of Molten Hafnium Infusion Into a B4C Packed-Bed
*Arturo Schiaffino, V. M. Krushnarao Kottedda, Vinod Kumar, Arturo Bronson, Sanjay Shantha-
Kumar*

AJKFluids2019-5360..... **V002T02A042**
Cavitation-Induced Interface Instability of Droplet Between Plates
Hongchen Li, Jingzhu Wang, Yiwei Wang

FLUID STRUCTURE INTERACTION (INCLUDING IBM)

AJKFluids2019-4639..... **V002T02A043**
Passive Pitching Mechanism of Three-Dimensional Flapping Wings in Hovering Flight
Chengyu Li, Junshi Wang, Geng Liu, Xiaolong Deng, Haibo Dong

AJKFluids2019-4697..... **V002T02A044**
A New Immersed Stress Method Based on Volume Average
Toshiaki Fukada, Shintaro Takeuchi, Takeo Kajishima

AJKFluids2019-4724..... **V002T02A045**
Numerical Simulation and Neural Network Study Using an Upstream Cylinder for Flow
Control of an Airfoil
Meihua Zhang, Zhongquan Charlie Zheng, Yangliu Liu, Xiaoyu Jiang

AJKFluids2019-4809..... **V002T02A046**
Reservoir Geomechanical Modeling and Ground Uplift During CO2 Injection Into Khuff
Reservoir
Sikandar Khan, Yehia Khulief, Abdullatif Al-Shuhail

AJKFluids2019-5077..... **V002T02A047**
Extra-Low Reynolds Number Vane Separation Using Immersed Boundary Method
Prasert Prapamonthon, Bo Yin, Guowei Yang

AJKFluids2019-5096..... **V002T02A048**
A Finite Element Based Partitioned Coupling Method for the Simulation of Flow-Induced Fiber Motion
Diwei Zhang, Xiaobo Peng, Dongdong Zhang

AJKFluids2019-5212..... **V002T02A049**
An Explicit Modeling Approach for Simulating Fluid-Structure Interaction Problems With Immersed-Boundary Finite-Volume Method
Yanbo Huang, Shanshan Li, Zhenhai Pan

AJKFluids2019-5422..... **V002T02A050**
Flutter Study on High Speed Train External Windshield by a Tight Coupling Method
Qian Jiang, Guannan Zheng, Guilin Zhao

HYBRID LES/RANS

AJKFluids2019-4696..... **V002T02A051**
A Dynamic Time Filtering Technique for Hybrid RANS-LES Simulation of Non-Stationary Turbulent Flow
Tausif Jamal, D. Keith Walters

AJKFluids2019-4920..... **V002T02A052**
Hybrid RANS-LES Simulation of Turbulent Heat Transfer in a Channel Flow With Imposed Spanwise and Streamwise Mean Temperature Gradient
Olalekan O. Shobayo, D. Keith Walters

AJKFluids2019-4937..... **V002T02A053**
Development and Validation of a Hybrid RANS-LES Approach Based on Temporal Filtering
Vladimir Duffal, Benoit de Laage de Meux, Remi Manceau

AJKFluids2019-5273..... **V002T02A054**
Numerical Investigation of Flow and Heat Transfer Characteristics for Attached and Separated Low-Pr Flows
S. Bhushan, M. Elmellouki, W. D. Jock, D. K. Walters, J. K. Lai, Y. A. Hassan, A. Obabko, E. Merzari

LES/DNS

AJKFluids2019-4843..... **V002T02A055**
Assessment of Compressible RANS and LES Methods for Organic Vapor Flows Past a NACA4412 Airfoil
Karsten Hasselmann, Stefan aus der Wiesche, Eugeny Y. Kenig

AJKFluids2019-5025..... **V002T02A056**
Direct Numerical Simulation of Radial Convection in a Cylindrical Annulus With and Without Rotation
Diogo B. Pitz, William R. Wolf

AJKFluids2019-5036..... **V002T02A057**
Validation and Development of DNS Database for Low Prandtl Numbers in Rod Bundle
Jonathan K. Lai, Elia Merzari, Yassin A. Hassan, Aleksandr Obabko

AJKFluids2019-5107..... **V002T02A058**
Large Eddy Simulation of Turbulent Combustion Flows in a Methane-Hydrogen Gasturbine Combustor and NOx Prediction by its Database
Nobuyuki Oshima, Ryosuke Kishine, Takeo Oda

AJKFluids2019-5418..... **V002T02A059**
Evaluation of Pressure-Strain Correlation As a Basis for Development of a Physics-Based Transition Onset Marker
Satish Muthu, Shanti Bhushan, D. Keith Walters

AJKFluids2019-5473..... **V002T02A060**
Wingtip Vortex Stability and Control Using Mean Flow Perturbation
Andrew L. Bodling, Daniel J. Garmann

AJKFluids2019-5498..... **V002T02A061**
Numerical Simulations of Turbulent Flow Through a 90 degrees Elbow
Ravon Venters, Brian Helenbrook, Goodarz Ahmadi

MULTI-PHYSICS SIMULATION

AJKFluids2019-4797..... **V002T02A062**
Numerical Simulation of Supercritical Octane Flows in a Heated Circular Tube With Simple Thermal Cracking Model
Takashi Furusawa, Noriyuki Taki, Shuto Yatsuyanagi, Satoru Yamamoto, Takuto Miyaura, Sadatake Tomioka

AJKFluids2019-4862..... **V002T02A063**
The Effect of Mixing Promoters on the Performance of Forward Osmosis Membrane Systems: Computational Fluid Dynamics Simulations
Ahmed M. Alshwairekh, Abdullah A. Alghafis, Anas M. Alwatban, Umar F. Alqsair, Alparslan Oztekin

AJKFluids2019-4975..... **V002T02A064**
Design and Development of a Small Multistage Flash Desalination System Using Aspen HYSYS
Md. Islam, F. Banat, A. Baba, S. Abuyahya

AJKFluids2019-5546..... **V002T02A065**
Study of Enhanced Self Mixing in Ferrofluid Flow in an Elbow Channel Under the
Influence of Non-Uniform Magnetic Field
Nadish Anand, Richard Gould

AJKFluids2019-5613..... **V002T02A066**
Numerical Simulation of Proppant Transportation in Hydraulic Fracture Based on
DDPM-KTGF Model
Yan Zhang, Xiaobing Lu, Xuhui Zhang, Peng Li

OPEN SOURCE CFD APPLICATIONS

AJKFluids2019-4698..... **V002T02A067**
Computational Fluid Dynamic Analysis of a Marine Hydrokinetic Crossflow Turbine in
Low Reynolds Number Flow
Minh N. Doan, Ivan H. Alayeto, Kana Kumazawa, Shinnosuke Obi

AJKFluids2019-5130..... **V002T02A068**
An Evaluation of Open Source CFD for Study of Aerodynamics of Vehicle Platooning
T. Farid, A. Shakeel, M. Sajid

AJKFluids2019-5425..... **V002T02A069**
Hydrodynamic Evaluation of Microtiter Plate Assay Using Computational Fluid
Dynamics for Biofilm Formation
R. Zahra, A. A. Khan, M. Sajid

AJKFluids2019-5435..... **V002T02A070**
Modeling and CFD Analyses of Gear Pump in OpenFOAM
G. Shoukat, Kamran Siddique, M. Sajid

AJKFluids2019-5447..... **V002T02A071**
DSMC Simulation of Rarefied Gas Flow Over a Wall Mounted Cube
Deepak Nabapure, Ram Chandra Murthy

AJKFluids2019-5454..... **V002T02A072**
Two-Phase Flow Simulation of High-Pressure Gas Atomization: Effect of Molten Metal
and Atomizing Gas Properties on Droplet Size Distribution
Kalpana Hanthanan Arachchilage, Majid Haghshenas, Ranganathan Kumar

AJKFluids2019-5611..... **V002T02A073**
Computational Evaluation of Stability in Slosh Dynamics of Tank Vehicles Using Zero
Moment Point
M. Usman, M. Sajid

OPTIMIZATION, DATA-BASED SIMULATIONS, AND MACHINE LEARNING

- AJKFluids2019-5056**..... **V002T02A074**
 CNN-SINDy Based Reduced Order Modeling of Unsteady Flow Fields
Takaaki Murata, Kai Fukami, Koji Fukagata
- AJKFluids2019-5079**..... **V002T02A075**
 Data-Driven Reduced Order Modeling of Flows Around Two-Dimensional Bluff Bodies
 of Various Shapes
Kazuto Hasegawa, Kai Fukami, Takaaki Murata, Koji Fukagata
- AJKFluids2019-5182**..... **V002T02A076**
 Optimization of a Cyclone Using Multiphase Flow Computational Fluid Dynamics
Justin Weber, William Fullmer, Aytekin Gel, Jordan Musser
- AJKFluids2019-5261**..... **V002T02A077**
 Predictability Study of Viscoelastic Turbulent Channel Flow Using Deep Learning
Atsushi Nagamachi, Takahiro Tsukahara
- AJKFluids2019-5415**..... **V002T02A078**
 Curvature Estimation Modeling Using Machine Learning for CLSVOF Method:
 Comparison With Conventional Methods
Majid Haghshenas, Ranganathan Kumar
- AJKFluids2019-5426**..... **V002T02A079**
 A Robust Aerodynamic Optimization Design for Airfoil Based on Interval Uncertainty
 Analysis Method
Xin Song, Guannan Zheng, Guowei Yang
- AJKFluids2019-5567**..... **V002T02A080**
 Branch and Bound Analysis to Characterize Phase Variations in Laser Propagation
 Through Deep Turbulence
*Luis F. Rodriguez, Vinod Kumar, Jose Espiritu, Arturo Bronson, Krushnarao Kotteda, Diego
 Lozano, Arturo Rodriguez*
- AJKFluids2019-5572**..... **V002T02A081**
 Reconstruction of RANS Model and Cross-Validation of Flow Field Based on Tensor
 Basis Neural Network
Xudong Song, Zhen Zhang, Yiwei Wang, Shuran Ye, Chenguang Huang