

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

VOLUME 3B
FLUID APPLICATIONS AND SYSTEMS

presented at
2019 8TH ASME-JSME-KSME JOINT FLUIDS ENGINEERING CONFERENCE
JULY 28-AUGUST 1, 2019
XLOCATIONX

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. 978-0-7918-5905-6

**© 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

FLUID APPLICATIONS AND SYSTEMS

PUMPING MACHINERY SYMPOSIUM

AJKFluids2019-4640..... V03BT03A001

Influence of Turbulence Models in Transient Simulations of Inducers Under Steady Operation

Bjorn Gwijsda, Matthias Mohr, Dennis Herrmann-Verspagen, Martin Bohle

AJKFluids2019-4648..... V03BT03A002

Transient Characteristics of a Centrifugal Pump at Rapid Startup

Teiichi Tanaka, Michiya Tabaru

AJKFluids2019-4676..... V03BT03A003

Multi-Objective Optimization of a High Specific Speed Centrifugal Volute Pump Using 3D Inverse Design Coupled With CFD Simulations

Luying Zhang, Gabriel Davila, Mehrdad Zangeneh

AJKFluids2019-4687..... V03BT03A004

Study on the Influence of Centrifugal Pump Inlet Flow Field Instability and Methods of Adjustment

Bo Qian, Jinping Chen, Peng Wu, Bin Huang, Dazhuan Wu

AJKFluids2019-4716..... V03BT03A005

Cryogenic Pumps Monitoring, Diagnostics and Expert Systems Using Motor Current Signature Analyses and Vibration Analyses

Peter Popaleny, Nicolas Peton

AJKFluids2019-4777..... V03BT03A006

Optimizing Pump Selection for Energy Efficiency Across Multiple Operating Conditions Using True Weighted Efficiency (TWE)

Trygve Dahl

AJKFluids2019-4800..... V03BT03A007

Effect of Interface Condition on the Hydraulic Performance of a Pump-Turbine at Various Guide Vane Opening Conditions in Pumping Mode

Jun-Won Suh, Seung-Jun Kim, Young-Seok Choi, Jin-Hyuk Kim, Won-Gu Joo, Jungwan Park

AJKFluids2019-4829..... V03BT03A008

The Effects of Multiphase, Multi-Viscosity Fluids on Axial Thrust and Cooling Flow Performance of a Canned Motor Pump

Eric Conaway, Jose Matos, Ryan Mesiano

- AJKFluids2019-4838.....V03BT03A009**
An Experimental Study of Influence of Slits in Throat Position on Suppression of Cavitation Instabilities in Liquid Propellant Rocket Inducer
Moena Kanamaru, Yoshito Kamikura, Satoshi Kawasaki, Takashi Shimura, Iga Yuka
- AJKFluids2019-4866.....V03BT03A010**
Stabilizing Pump-Turbine Operations Using Water Injection Passive Control
Muhannad Altimemy, Bashar Attiya, Cosan Daskiran, I-Han Liu, Alparslan Oztekin
- AJKFluids2019-4875.....V03BT03A011**
Effects of Trailing Edge Position of Splitter Blade on the Pressure Pulsation in a Low Specific Centrifugal Pump
Jinfeng Zhang
- AJKFluids2019-4878.....V03BT03A012**
Effects of Splitter Vanes on the Performance and Pressure Pulsation in a Centrifugal Pump
Chao Li, Bo Gao, Ning Zhang, Dan Ni
- AJKFluids2019-4879.....V03BT03A013**
Effects of the Circulating Jet Flow on the Suction Flow Field and Cavitation in a Canned Motor Pump
Laizuo Chen, Minguan Yang, Wei Cui, Bo Gao, Ning Zhang, Dan Ni
- AJKFluids2019-4883.....V03BT03A014**
Experimental Approach to Predict the Residual Axial Thrust in Centrifugal Pumps
Giulio Elicio, Francesco Annese
- AJKFluids2019-4886.....V03BT03A015**
Flow Field and Performance Analysis of a Centrifugal Pump During Unstable Operating Conditions
Romain Prunieres, Chisachi Kato
- AJKFluids2019-4906.....V03BT03A016**
Experimental Investigation on Cavitation Performance of Torque Converter Using Transparent Model
Yusuke Katayama, Yuki Hosoi, Yuta Fukuda, Satoshi Watanabe, Shin-ichi Tsuda, Yoshihide Mori, Kazuyoshi Ito
- AJKFluids2019-4914.....V03BT03A017**
Research of Unsteady Characteristics of Torque in Centrifugal Pumps
Luo Yin, Han Yuejiang, Dong Jian
- AJKFluids2019-4932.....V03BT03A018**
Pressure Fluctuation Reduction in Side Channel Pumps Using a Modified Impeller Blade
Xueyuan Wei, Fan Zhang, Desmond Appiah, Ke Chen, Shouqi Yuan, Martin Bohle

AJKFluids2019-4938.....	V03BT03A019
On the Influence of Gas Content on the Rotordynamic Force Coefficients of a Three-Wave (Air in Oil) Annular Seal for Multiple Phase Pumps	
<i>Luis San Andres, Xueliang Lu, Tingcheng Wu</i>	
AJKFluids2019-4961.....	V03BT03A020
Investigation of the Pump, Dissipation and Inverse Turbine Operating Modes Using the CATHARE-3 One-Dimensional Rotodynamic Pump Model	
<i>Laura Matteo, Fabien Cerru, Antoine Dazin, Nicolas Tauveron</i>	
AJKFluids2019-4970.....	V03BT03A021
Theoretical Analyses of the Number of Backflow Vortices on an Axial Pump or Compressor	
<i>Yu Ito, Yuhei Sato, Takao Nagasaki</i>	
AJKFluids2019-5029.....	V03BT03A022
Experimental Visualization of Gas-Liquid Flow Patterns in a Centrifugal Rotor	
<i>Henrique Stel, Edgar Minoru Ofuchi, Rafael Fabricio Alves, Sergio Chiva, Rigoberto E. M. Morales</i>	
AJKFluids2019-5053.....	V03BT03A023
Characteristics of Swirl Angle in Pump Intake Flow Near the Minimum Inlet Submergence	
<i>Tajul Ariffin Norizan, Zambri Harun, Wan Hanna Melini Wan Mohtar, Shahrir Abdullah</i>	
AJKFluids2019-5066.....	V03BT03A024
Investigation and Analysis of the Flow Field Induced by a Symmetrical Suction Elbow at the Pump Inlet	
<i>Sebastian Muntean, Alin Ilie Bosioc, Ionel Aurel Draghici, Liviu Eugen Anton</i>	
AJKFluids2019-5081.....	V03BT03A025
Investigation of Pressure Pulsation in the Stages of an Electric Submersible Pump at Best Efficiency Point Under Various Speeds	
<i>Dhanasekaran Arumugam, Kumaraswamy Sivasailam</i>	
AJKFluids2019-5093.....	V03BT03A026
Effect of Rotating Speed on Performance of Electrical Submersible Pump	
<i>Yang Yang, Ling Zhou, Weidong Shi, Chuan Wang, Wei Li, Ramesh Agarwal</i>	
AJKFluids2019-5132.....	V03BT03A027
Assessment of Noise Signature for a Cavitating Centrifugal Pump	
<i>Christopher Stephen, Kumaraswamy Sivasailam</i>	
AJKFluids2019-5180.....	V03BT03A028
The Transient Characteristics Analysis of Pump During Rapid Valve Opening and Closing	
<i>Shuai Yang, Shiyang Li, Dazhuan Wu, Kai Zhang, Qiao Li, Zhongtian Xu</i>	

AJKFluids2019-5183.....	V03BT03A029
3D Modeling of Unsteady Flow Characteristics in ALIP Pump	
<i>Ruijie Zhao, Heng Miao, Desheng Zhang, Jun Huang, Xiongfa Gao</i>	
AJKFluids2019-5205.....	V03BT03A030
Large Eddy Simulation of a Submerged Vortex in a Simplified Computational Model	
<i>Yoshinobu Yamade, Chisachi Kato, Takahide Nagahara, Jun Matsui</i>	
AJKFluids2019-5251.....	V03BT03A031
Effects of Volute Cross-Sectional Area Distribution on Performance of Double-Suction	
Volute Pump	
<i>Szu Yung Chen, Lu Zhang, Yumiko Sekino, Hiroyoshi Watanabe</i>	
AJKFluids2019-5274.....	V03BT03A032
The Effect of Suction Pressure and Flow Rate on the Dynamic Characteristics of a	
Cavitating Inducer	
<i>Yuta Morimoto, Takafumi Sugiura, Hironori Horiguchi, Kazuyasu Sugiyama</i>	
AJKFluids2019-5359.....	V03BT03A033
Numerical Analysis of Contraction Geometry Effects on Cavitation Choking in a Piping	
System	
<i>Motohiko Nohmi, Shusaku Kagawa, Tomoki Tsuneda, Wakana Tsuru, Kazuhiko Yokota</i>	
AJKFluids2019-5371.....	V03BT03A034
Inducer Design Optimization to Improve its Suction Performance	
<i>Yushi Nakamura, Marek Lubieniecki, Kentarou Hayashi, Yutaka Kawata, Masahiro Miyabe,</i>	
<i>Claudio Lettieri</i>	
AJKFluids2019-5372.....	V03BT03A035
Numerical Investigation of the Influence of Impeller-Diffuser Gap (A- and B-Gaps) on	
Unsteady Flow in a Centrifugal Pump at Part Flows	
<i>Taiki Takamine, Satoshi Watanabe</i>	
AJKFluids2019-5402.....	V03BT03A036
Dynamic Characteristics of Blade Surface Cavitation on Various Types of Hydrofoils	
<i>Hironori Horiguchi, Masakazu Toyoshima, Takuya Matsuda, Kazuyasu Sugiyama</i>	
AJKFluids2019-5439.....	V03BT03A037
Validation of a Developed Assessment Procedure for the Functional Performance of	
Wastewater Pumps	
<i>Michael Pohler, Umit Hasirci, Tim Rese, Paul Uwe Thamsen</i>	
AJKFluids2019-5446.....	V03BT03A038
Investigations Into Wet Wipe Related Clogging Phenomena of Wastewater Pumps	
<i>Raja-Louisa Mitchell, Susanne Busche, Paul Uwe Thamsen</i>	

AJKFluids2019-5450.....	V03BT03A039
Design of a New Type of Balance Drum to Reduce Axial Loading in Centrifugal Pumps	
<i>K. A. J. Bruurs, B. P. M. van Esch, M. S. van der Schoot, E. J. J. van der Zijden</i>	
AJKFluids2019-5486.....	V03BT03A040
Predictive Model for Two-Phase Flow Performance of Mixed Flow Pumps	
<i>Abhay Patil, Burak Ayyildiz, Sahand Pirouzpanah, Adolfo Delgado, Gerald Morrison</i>	
AJKFluids2019-5538.....	V03BT03A041
A Numerical Study of Turbulence Model and Rebound Model Effect on Erosion Simulations in an Electrical Submersible Pump (ESP)	
<i>Haiwen Zhu, Jun Zhang, Jianjun Zhu, Risa Rutter, Hong-Quan Zhang</i>	
AJKFluids2019-5599.....	V03BT03A042
Unsteady Flow in the Vaned Diffuser of a Low Specific Speed Centrifugal Pump With an Unshrouded Impeller	
<i>Asuma Ichinose, Tomoki Takeda, Kazuyoshi Miyagawa, Yohei Ogawa, Hideyo Negishi, Kazuki Niizuma</i>	
AJKFluids2019-5600.....	V03BT03A043
Dynamic Characteristics of Unshrouded Impellers Equipped With Balance Piston Systems for Rocket Turbo Pumps	
<i>Tomoyuki Hayashi, Mamiko Yoshimura, Keisuke Matsumoto, Kazuyoshi Miyagawa, Satoshi Kawasaki, Junya Takida, Hiromichi Hiraki, Naohito Suwa</i>	
AJKFluids2019-5610.....	V03BT03A044
On the Effect of Trailing Edge Under-Filing on the Apparent Slip Factor of Centrifugal Impellers	
<i>Oliver Litfin, Antonio Delgado</i>	
AJKFluids2019-5616.....	V03BT03A045
Theoretical Optimization of Splitter Blade Geometry in High-Efficiency Centrifugal Turbopumps	
<i>Alessandro Apollonio, Francesco Maddaluni, Angelo Pasini, Dario Valentini, Luca d'Agostino</i>	
AJKFluids2019-5617.....	V03BT03A046
Analysis of a Centrifugal Pump Equipped With an Axial Rotor With Variable Speed	
<i>Alin Ilie Bosioc, Daniel Calin Mos, Sebastian Muntean, Liviu Eugen Anton</i>	
AJKFluids2019-5620.....	V03BT03A047
Thermal Cavitation Instability Analysis in Axial Inducers by Means of Casing and Hub-Mounted Pressure Sensors	
<i>Ruzbeh Hadavandi, Angelo Pasini, Dario Valentini, Giovanni Pace, Luca d'Agostino</i>	
AJKFluids2019-5633.....	V03BT03A048
Effect of Diffuser Vane Solidity on Performance of a Multistage Bowl Pump	
<i>Paul Cooper, Ashvin Hosangadi</i>	

AJKFluids2019-5657.....V03BT03A049

Evaluate a New Pump Design Using CFD Simulation

Hui Ding, Benjamin Greenfield

AJKFluids2019-5660.....V03BT03A050

Experimental Investigation of the Flow Inside the Rotor Passage of an Axial Ventricular Assist Device

Huang Chen, Primoz Dresar, Bryan Lynch, Paarth Sharma, Christopher Williams, Joseph Katz

AJKFluids2019-5661.....V03BT03A051

CFD-Based Hydraulic Design and Manufacturing of a Multistage Low Specific-Speed Diffuser Pump

Martijn van der Schoot, Kevin Bruurs, Eric van der Zijden

AJKFluids2019-5663.....V03BT03A052

Capturing S-Shape of Pump-Turbines by CFD Simulations Using an Anisotropic Turbulence Model

Ernesto Casartelli, Luca Mangani, Armando Del Rio, Angelika Schmid

AJKFluids2019-5665.....V03BT03A053

Numerical and Experimental Investigation on the Influence of Blades Gap Flow on Axial Blood Pump Performance

Guangmao Liu, Donghai Jin, Mengyu Wang, Xingmin Gui

AJKFluids2019-5668.....V03BT03A054

Research on the Performance of Check Valve at a Long Distance Pumping System

Huili Bi, Honggang Fan, Bin Cao, Yu Xu

ROTATING MACHINERY/TURBOMACHINERY

AJKFluids2019-4638.....V03BT03A055

Prediction of Aerodynamic Noise for Centrifugal Fan of Air-Conditioner by Tetra-Prism Grids

Taku Iwase, Daiwa Sato, Hideshi Obara, Yoshinobu Yamade, Chisachi Kato

AJKFluids2019-4657.....V03BT03A056

Two Flow Models for Designing Hydrostatic Bearings With Porous Material

M. Bohle, Y. Gu, A. Schimpf

AJKFluids2019-4695.....V03BT03A057

Experimental Investigations of a Comb-Like Film Cooling Scheme

Hao-Ming Li, Wahid Ghaly, Ibrahim Hassan

AJKFluids2019-4699.....V03BT03A058

Predicting Cooling Fan Noise of Electric Motor Using Compressible Large Eddy Simulation

Kimihisa Kaneko, Tsutomu Yamamoto

AJKFluids2019-4732.....	V03BT03A059
Numerical Method for Studying Bearing Gap Pressure Wave Development and Subsequent Performance Mapping of Externally Pressurized Gas Journal Bearings	
<i>Tom M. Lawrence, Marvin D. Kemple</i>	
AJKFluids2019-4805.....	V03BT03A060
Inter-Blade Vortex Characteristics With the Blockage Effects of Runner Blade in a Francis Hydro Turbine Model	
<i>Seung-Jun Kim, Jin-Hyuk Kim, Young-Seok Choi, Yong Cho, Jong-Woong Choi</i>	
AJKFluids2019-4849.....	V03BT03A061
Numerical Study on the Flow Field Analysis and Optimization of Turbine in Supercritical Compressed Air Energy Storage	
<i>Meng Wang, Jianqiang Deng, Yang He, Haisheng Chen, Yujie Xu</i>	
AJKFluids2019-4867.....	V03BT03A062
Mitigation of Flow-Induced Pressure Fluctuations in a Francis Turbine Using Water Injection	
<i>Muhannad Altimemy, Bashar Attiya, Cosan Daskiran, I-Han Liu, Alparslan Oztekin</i>	
AJKFluids2019-4877.....	V03BT03A063
Operational Performance and Locally Resolved Outflow of Brush Seals	
<i>Fabian Schur, Jens Friedrichs</i>	
AJKFluids2019-4903.....	V03BT03A064
Redesign and Performance Analysis of Medium Flow Coefficient Centrifugal Compressor	
<i>Khaled Yousef, Abraham Engeda, Ahmed Hegazy</i>	
AJKFluids2019-4908.....	V03BT03A065
Development of High-Efficiency Half-Ducted Propeller Fan for Air-Conditioners by Blade Tip Shape Modification	
<i>Masashi Yoshikawa, Hiroyuki Toyoda, Hisashi Daisaka</i>	
AJKFluids2019-4916.....	V03BT03A066
Numerical Design of a Partial-Support Axial Blood Pump	
<i>Guangmao Liu, Donghai Jin, Mengyu Wang, Xingmin Gui</i>	
AJKFluids2019-4939.....	V03BT03A067
Experimental Tests With Centrifugal Pumps: Degradation of Performance, Instability and Dynamic Phenomena With Non-Newtonian Suspensions of Kaolin in Water	
<i>Matteo Occari, Enrico Munari, Valentina Mazzanti, Michele Pinelli, Francesco Mollica, Alessio Suman</i>	
AJKFluids2019-4958.....	V03BT03A068
Suppression of the Surging Phenomenon by Modifying Tongue Shape of Air Conditioner Mounted With Cross-Flow Fan	
<i>Haruki Nukaga, Hiroshi Maita, Hisashi Daisaka</i>	

AJKFluids2019-4974.....	V03BT03A069
Flow Visualization Study of Jet and Bucket Interactions in Traditional and Hooped Pelton Runner	
<i>Gaurangkumar Chaudhari, Salim Channiwala, Samip Shah, Digvijay Kulshreshtha</i>	
AJKFluids2019-4990.....	V03BT03A070
Numerical Investigation of Tip Leakage Vortex Cavitation in Axial Waterjet Pump With Different Tip Gap Sizes	
<i>Shun Xu, Bin Ji, Xinping Long, Zhongdong Qian, Guibin Li, Jiajian Zhou</i>	
AJKFluids2019-5070.....	V03BT03A071
Aerodynamic Design and Assessment of a Compact, Single Stage Axial Fan for Low Noise Emission	
<i>Daniel Kessler, Daniel Giesecke, Jens Friedrichs, Jorg Leuschner</i>	
AJKFluids2019-5078.....	V03BT03A072
Effects of Curvature Radius of Volute Profile on Aerodynamic Performance of Squirrel Cage Fan	
<i>Ke Wang, Yaping Ju, Chuhua Zhang</i>	
AJKFluids2019-5207.....	V03BT03A073
Visualization of Oil Droplets Distribution in a Rotary Compressor	
<i>Puyuan Wu, Jun Chen, Paul E. Sojka</i>	
AJKFluids2019-5283.....	V03BT03A074
Effect of Stator Geometry on the Performance of a Positive Displacement Hydraulic Turbine	
<i>Arihant Sonawat, Jin-Hyuk Kim, Seung-Jun Kim, Young-Seok Choi, Hyeon-Mo Yang, Yong-Kab Lee, Kyung-Min Kim</i>	
AJKFluids2019-5349.....	V03BT03A075
Investigation of Magnetic Journal Bearing Instability Issues in Supercritical CO ₂ Turbomachinery	
<i>Dokyu Kim, SeungJoon Baik, Jeong Ik Lee</i>	
AJKFluids2019-5367.....	V03BT03A076
Secondary Flow Loss Reduction Method by Use of 3D-Fence in a Gas Turbine Cascade	
<i>Ryota Uehara, Syohei Mizuguchi, Kakeru Kusano, Masahiro Miyabe, Yutaka Kawata</i>	
AJKFluids2019-5368.....	V03BT03A077
Improvement of Film Cooling Effectiveness in the Gas Turbine Endwall by Use of Optimization Framework	
<i>Daisuke Hata, Kazuto Kakio, Yutaka Kawata, Masahiro Miyabe</i>	
AJKFluids2019-5429.....	V03BT03A078
Leakage Rate Performance Mapping of Smooth Stator/Grooved Rotor Labyrinth Seals Using Statistical Tools	
<i>Hanxiang Jin, Alexandrina Untaroiu</i>	