

THE 10TH ASIAN INTERNATIONAL CONFERENCE ON FLUID MACHINERY

Kuala Lumpur, Malaysia 21-23 October 2010

EDITORS

Dr. Mazlan Abdul Wahid
Dr. Jamaluddin Md Sheriff
Dr. Nor Azwadi Che Sidik
Dr. Syahrullail Samion

*Universiti Teknologi Malaysia
Skudai, Johor, Malaysia*

SPONSORING ORGANIZATIONS

Asian Fluid Machinery Committee
Institute of Engineer Malaysia

AIP

American Institute
of Physics

Melville, New York, 2010

AIP CONFERENCE PROCEEDINGS ■ 1225

CONTENTS

Preface	xiii
Committees	xv

PLENARY SESSION PRESENTATIONS

Advanced Technologies for Turbomachinery to Utilize Effectively Renewable Energies at Offshore	3
T. Kanemoto	
On the Development of Concave Surface Boundary Layer Flows	10
S. H. Winoto, Tandionol, D. A. Shah, and H. Mistudharmadi	

PARALLEL SESSION CONTRIBUTIONS

SESSION 1A: FLUID DYNAMICS OF FLUID MACHINERY

Counter-Top Thermoacoustic Refrigerator—An Experimental Investigation	29
M. Anwar and N. M. Ghazali	
Preliminary Response Analysis of AUV	36
A. Hariri, S. M. Basharie, and M. H. A. Ghani	
Effect of Guide Vane in Ring Groove Arrangement for a Small Turbocharger	47
D. Sakaguchi, K. Nagoshi, M. Tanimura, M. Ishida, and H. Ueki	
Basic Characteristics of Autorotating Flat Plate in Flow	55
K. Hirata, M. Kondo, T. Nishikawa, K. Shimizu, and J. Funaki	
Numerical and Experimental Study on Aerodynamic Characteristics of Basic Airfoils at Low Reynolds Numbers	62
K. Hirata, M. Kihira, T. Iijima, M. Koga, and J. Funaki	

SESSION 1B: MONITORING AND DIAGNOSIS

A Study on Evacuation Performance of Siphon-Type Water Closets	75
W.-S. Cheng, R.-T. Lee, C.-H. Liu, and C.-W. Hsia	
Auto Detection for High Level Water Content for Oil Well	81
J. B. Janier and Z. A. B. Jumaludin	
Experimental Study on Leakage Flow in Labyrinth Seals with Asymmetric Geometries	91
K. Nishii, A. Furukawa, S. Watanabe, and K. Miyake	
Flow Characteristics in Scroll Casing of Sirocco Fan	100
H. Hayashi, T. Yamasaki, T. Ohnishi, T. Fukano, and S. Sasaki	
Cleaning and Heat Transfer in Heat Exchanger with Circulating Fluidized Bed	110
H. K. Kang, S. W. Ahn, J. W. Choi, and B. C. Lee	

SESSION 1C: PUMP

Effect of J-Groove on the Axial Thrust in Centrifugal Pump	129
J. Matsui and T. Mugiya	
Study on Operation Optimization of Pumping Station's 24 Hours	
Operation under Influences of Tides and Peak-Valley Electricity Prices	137
Y. Gong, J. Cheng, L. Zhang, and R. Zhang	
Development and Optimized Design of Propeller Pump System & Structure with VFD in Low-Head Pumping Station	147
R. Zhang, H. Zhu, A. Jaap, and L. Yao	
Numerical Simulation of Tubular Pumping Systems with Different Regulation Methods	162
H. Zhu, R. Zhang, D. Deng, X. Feng, and L. Yao	
Optimal Operation of Variable Speed Pumping System in China's Eastern Route Project of S-To-N Water Diversion Project	169
J. Cheng, L. Zhang, R. Zhang, Y. Gong, H. Zhu, D. Deng, X. Feng, and J. Qiu	

SESSION 2A: FLUID DYNAMICS OF FLUID MACHINERY

A DNS Investigation of Non-Newtonian Turbulent Open Channel Flow	179
R. Guang, M. Rudman, A. Chryss, P. Slatter, and S. Bhattacharya	
Numerical Calculation for Whirling Motion of a Centrifugal Blood Pump with Cinical Spiral Groove Bearings	185
D. Shigemaru and H. Tsukamoto	
Thermoacoustic Refrigerator's Stack Optimization	193
M. H. El-Fawal, N. M. Ghazali, M. S. Yaacob, and A. N. Darus	
The Effect of Lubricant Viscosity in High Pressure Forming	205
S. Syahrullail, M. J. M. Ridzuan, and W. B. Seah	

SESSION 2B: MONITORING AND DIAGNOSIS

Duct Water Current Turbine and Extremely Low Head Helical Turbine	213
S. Phommachanh, P. Sutikno, and O. Shinnosuke	
Experiments on Combustion Kernel Growth in Gaseous Explosions	225
K. M. Saqr, M. A. Wahid, H. Ujir, and M. M. Sies	
Time Domain Analysis of Acoustic Emission Signal for Internal Surface Roughness Classification	236
M. H. B. Zohari, C. K. E. N. Che Ku Husin, and M. H. M. Saad	
Performance of Diesel Engine Using Blended Crude Jatrophia Oil	242
K. A. Kamarudin, N. S. A. M. Sazali, M. F. M. Ali, A. J. Alimin, and S. A. Khir	
An Investigation of the Water Flow Past the Butterfly Valve	249
W. Chaiworapueki, J.-Y. Champagne, M. El-Hajem, and C. Kittichaikan	

SESSION 2C: PUMP

Study of Impeller Design for Pipe Flow Generator with CFD and RP	265
S.-H. Wang, C. F. H. Porres, M.-Y. Zuo, and W.-J. Xiao	
Study on Performance and Internal Flow Condition of Mini Turbo-Pump . . .	276
T. Shigemitsu, J. Fukutomi, and R. Nasada	
Design Optimization of Mixed-Flow Pump Impellers and Diffusers in a Fixed Meridional Shape	287
S. Kim, Y.-S. Choi, and K.-Y. Lee	
Research on Optimal Operation by Adjusting Blade Angle in Jiangdu No. 4 Pumping Station of China	297
L. Zhang, J. Chen, R. Zhang, and Y. Gong	
Proposal of Unique Process Pump with Floating Type Centrifugal Impeller (Preliminary Report: Axial Thrust Impeller with Driving Shaft) . . .	304
R. Kawashima, T. Kanemoto, K. Sakamoto, and M. Uno	

SESSION 3A: FLUID DYNAMICS OF FLUID MACHINERY

Numerical Analysis for Structural Safety Evaluation of Butterfly Valves	319
M.-S. Shin, J.-Y. Yoon, and H.-Y. Park	
Numerical Simulation of Plain Fin-And-Round Tube Heat Exchanger under Frost Condition	327
A. A. Hussein, A. R. Abu Talib, and N. M. Adam	
Investigation of Flow Field in Bent Duct	333
U. J. Roh, H. J. Kim, Y. W. Jung, and S. J. Song	
Parametric Study for Optimal Design of a Piping System in a Serially Connected Multi-Stage Turbo Blower	342
C.-M. Jang and Y.-B. Park	
Optimization of a Circular Microchannel with Entropy Generation Minimization Method	351
A. Jafari and N. M. Ghazali	

SESSION 3B: MONITORING AND DIAGNOSIS

Pressure Variation at Load Rejection of Bulb Turbine with a Long Penstock and Its Hydrographic Model Test	365
S. Yamato, S. Nakamura, and A. Furukawa	
Two-Phase Flow Analyses in Rotary Dryer with Agitator	375
S.-O. Jeon, S.-H. Cho, G.-Y. Song, and Y.-J. Kim	
Evaluation of Aircraft Wing-Tip Vortex Using PIV	382
O. A. Alsayed, W. Asrar, and A. A. Omar	
Numerical Solution of Hydrodynamics Lubrications with Non-Newtonian Fluid Flow	391
K. Osman, J. M. Sheriff, M. Z. Bahak, A. Bahari, and Asral	
Pressure Analysis in Point Contact for Elastohydrodynamic Lubrication	401
J. M. Sheriff, K. Osman, S. B. C. Kar, and Asral	

SESSION 3C: PUMP

Unsteady and Three Dimensional PTV Measurements of Flow Structure in a Suction Sump	415
J. Funaki, K. Inagaki, A. Shintani, R. Kawaguchi, and K. Hirata	
Counter-Rotating Type Pump Unit (Rotational Behaviors)	423
S. Itou, M. Fujimura, S. Nonoue, and T. Kanemoto	
Inducer Design to Avoid Cavitation Instabilities	433
D. Kang, T. Watanabe, K. Yonezawa, H. Horiguchi, Y. Kawata, and Y. Yoshinobu	
Analysis of Variable Speed Optimization Operation Effect of Different-Type Pumps in Jiangdu Pumping Station	447
J. Qiu, J. Chen, J. Luo, R. Zhang, L. Zhang, and Y. Gong	
Numerical Simulation of Centrifugal Pump with Double-Suction Impeller ...	456
Y.-J. An and B. R. Shin	

SESSION 4A: RENEWABLE ENERGY I

Sustainable Rural Energy: Traditional Water Wheels in Padang (PWW) Indonesia	467
G. A. Ibrahim, C. H. C. Haron, and C. H. Azhari	
Towers for Offshore Wind Turbines	475
V. J. Kurian, S. P. Narayanan, and G. Ganapathy	
Wood Combustion Behaviour in a Fixed Bed Combustor	488
E. M. Tokit, A. A. Aziz, and N. M. Ghazali	
Limitations of Commercializing Fuel Cell Technologies	498
N. Nordin	
Innovative Power-Augmentation-Guide-Vane Design of Wind-Solar Hybrid Renewable Energy Harvester for Urban High Rise Application	507
C. W. Tong, M. Z. Zainon, P. S. Chew, S. C. Kui, W. S. Keong, and P. K. Chen	
Suitability of Using the Accelerometer for Impulse Measurement of a Pulse Combustion Tube	522
M. A. Wahid, M. H. Ujir, H. Afifi, and M. M. Sies	

SESSION 4B: FLOW METERS AND VALVES

Diagnostic Flow Metering Using Ultrasound Tomography	533
S. Chun, B.-R. Yoon, K.-B. Lee, and J.-S. Park	
Effect of Flow Characteristics in the Downstream of Butterfly Valve on the Flow Rate Measurement Using Venturi Tube	540
S. H. Yoon, J. Lee, C. H. Yu, S.-J. Park, and C.-H. Chung	
Effect of Upstream Turbulence on Measurement Uncertainty of Flow Rate by Venturi	550
J. Lee, S. H. Yoon, C.-H. Yu, S.-J. Park, and C.-H. Chung	
An Investigation of the Water Flow Past the Butterfly Valve	562
W. Chaiworapuek, J.-Y. Champange, and M. El-Hajem	

SESSION 4C: COMPRESSORS

The Effect of Rotor Blade Speed to the Best Efficiency Point of Single Stage Axial Flow Compressor	579
M. F. Sukri, F. Wasbari, and S. Mat	
Rotating Instability of a Centrifugal Compressor with 2-Dimensional Impeller	587
K. J. Kang, Y. H. Shin, and K. H. Kim	
Design of a CO₂ Twin Rotary Compressor for a Heat Pump Water Heater . .	596
J. M. Ahn, W. Y. Kim, H. J. Kim, S. O. Cho, and J. C. Seo	
Flow and Performance Calculations of Axial Compressor Near Stall Margin	605
Y. Hwang and S.-H. Kang	

SESSION 5A: RENEWABLE ENERGY II

Flow Characteristics in an Augmentation Channel of Direct Drive Turbine for Wave Power Generation	619
D. Prasad, M. A. Zullah, Y.-D. Choi, and Y.-H. Lee	
Numerical Hydraulic Study on Seawater Cooling System of Combined Cycle Power Plant	628
J. Y. Kim, S. M. Park, J. H. Kim, and S. W. Kim	
Combustion Performance and Exhaust Emission of DI Diesel Engine Using Various Sources of Waste Cooking Oil	636
M. Afiq, M. Azuhairi, and W. Jazair	
Study on the Performance of Helical Savonius Rotor for Wave Energy Conversion	641
M. A. Zullah, D. Prasad, Y.-D. Choi, and Y.-H. Lee	
Conceptual Design of 100kW Energy Integrated Type Bi-Directional Tidal Current Turbine	650
K. P. Kim, M. R. Ahmed, and Y. H. Lee	
Numerical Analysis of Flow and Heat in Variable Angle Slider Bearing	660
K. Osman, J. M. Sheriff, M. F. bin Zainal, A. N. Bin Matzin, and Asral	

SESSION 5B: HIGH EFFICIENCY AND LOW NOISE FANS

A Preliminary Axial Fan Design Method with the Consideration of Performance and Noise Characteristics	677
C. Lee and H. G. Kil	
Performance Characteristic on Turbo Blowers Connected in Serial and Controlled by Inverter	685
C.-M. Jang and S.-H. Yang	
Design Optimization of an Axial Fan Blade through Multi-Objective Evolutionary Algorithm	696
J.-H. Kim, J.-H. Choi, A. Husain, and K.-Y. Kim	

Design of Side Channel Type Regenerative Blower	704
K.-Y. Lee, Y.-S. Choi, and K.-H. Jeong	
Performance Improvement of High Speed Jet Fan	712
Y.-S. Choi, J.-H. Kim, K.-Y. Lee, and S.-H. Yang	
Aerodynamics Design of Slim and High-Efficient Turbo-Fan	725
M.-J. Lee, W.-S. Song, H.-J. Jo, K.-B. Choi, D.-J. Park, and S. Lee	
Flow Characteristics with Variations of Cut-Off Angle of Multi-Blade Fan for Ventilation	732
K. Y. Kang, J. G. Park, Y. H. Shin, and K. H. Kim	

SESSION 5C: COMPUTATIONAL FLUID DYNAMICS

Radiation Effects on Free Convection Flow Past an Impulsively Started Infinite Vertical Plate with Ramped Wall Temperature and Constant Mass Diffusion	743
M. Narahari and O. A. Bég	
Preliminary Theoretical Study of the Formation and Growth of Droplets in Nucleating Flows	751
H. Hasini, M. Z. Yusoff, and N. H. Shuaib	
Modelling of Air Bubble Rising in Water and Polymeric Solution	758
N. M. S. Hassan, M. M. K. Khan, M. G. Rasul, and N. Subaschandar	
Large Eddy Simulation of the Dynamic Response of an Inducer to Flow Rate Fluctuations	769
D. Kang, K. Yonezawa, T. Ueda, N. Yamanishi, C. Kato, and Y. Tsujimoto	
Study of Plume Behavior Two Heated Cylinders at High Rayleigh Number Using Lattice Boltzmann Method	780
A. R. M. Rosdzimin, N. A. C. Sidik, and S. M. Zuhairi	
Cubic-Interpolated-Pseudo-Particle Lattice Boltzmann Method for Simulation of Natural Convection Heat Transfer in an Enclosure	788
M. A. Mussa, S. Abdullah, C. S. N. Azwadi, and N. Mohamad	
Numerical Dynamic Simulation of Optimized Cross-Flow Heat Exchanger with Various Refrigerants	796
K. Osman, R. P. Jong, and M. S. Shariff	

SESSION 6A: HYDRO TURBINE

Trash Diverter Orientation Angle Optimization at Run-Off River Type Hydro-Power Plant Using CFD	807
K. M. Munisamy, A. Kamal, N. H. Shuaib, M. Z. Yusoff, H. Hasini, A. Z. Rashid, S. K. Thangaraju, and H. Hamid	
Numerical Simulation of the Francis Turbine and CAD Used to Optimized the Runner Design (2nd)	816
P. Sutikno	
Simulations of Blade Angle Effects on EGAT-Micro Hydro Turbine	826
W. Nuantong and S. Taechajedcadarungsri	

Development of New Remaining Life Estimation Method for Main Parts of Hydro-Turbine in Hydro Electric Power Station	834
T. Yanagawa, M. Kaneko, I. Iida, and R. Fujikawa	

SESSION 6B: GAS AND STEAM TURBINES & JET TECHNOLOGIES

Numerical Investigation on the Separated Flow of Axial Flow Stator in Diagonal Flow Fan	843
Y. Kinoue, N. Shiomi, T. Setoguchi, K. Kaneko, and Y. Jin	
Nonlinear Aeroelastic Analysis of 3D a MW-Class Wind Turbine Blade Using CFD and CMBD Coupling Method	852
D.-M. Kim, D.-H. Kim, Y.-H. Kim, K.-K. Park, and S.-H. Kim	
Effect of Stand-Off Distance on Impact Pressure of High Speed Water Jets . .	864
W. Sittiwong, W. Seehanam, K. Pianthong, and A. Matthujak	
Development of Air Supply System for Gas Turbine Combustor Test Rig	874
N. I. Kamarudin, M. Hanafi, A. R. Mantari, and M. N. M. Jaafar	
Development of a Small Gas Turbine Combustor	881
M. I. B. Rahim, M. H. B. Asril, R. Mantari, and M. N. M. Jaafar	

SESSION 7A: COMPUTATIONAL FLUID DYNAMICS

Analyzing the Effect of Free Stream Turbulence on Gaseous Non-Premixed Flames	891
K. M. Saqr, M. M. Sies, and M. A. Wahid	
A CFD Study on Aerodynamic Characteristics of a Middle Wing for WIG Catamaran during Ground Effect	901
A. Priyanto, A. Maimun, S. Jamei, and I. Suharyanti	
The Development of Duct for a Horizontal Axis Turbine Using CFD	909
M. P. A. Ghani, O. Yaacob, and A. A. Aziz	
CFD Approach to Investigate the Flow Characteristics in Bi-Directional Ventilated Brake Disc	921
K. M. Munisamy, M. Z. Yusoff, N. H. Shuaib, and S. K. Thangaraju	
Simulation of Natural Convection Heat Transfer in an Inclined Square Cavity with Perfectly Conducting Side Walls Using Finite Different Approach	931
C. S. N. Azwadi and M. Y. M. Fairus	

SESSION 7B: MISCELLANEOUS

Numerical Simulation of Slinger Combustor Using 2-D Axisymmetric Computational Model	941
S. Lee, S. H. Park, and D. Lee	
Heat/Mass Transfer Measurement on the Tip Surface of Rotor Blade with Sqlear Rim	952
J. S. Park, D. H. Lee. W. J. Lee, H. H. Cho, D.-H. Rhee, and S.-H. Kang	

Three-Dimensional Numerical Analysis of Laminar Heat Exchanger with Respect to Fin Shape and Fan Performance	959
S. M. Park, J. Y. Kim, S. S. Seol, D. J. Lee, and M. C. Lee	

POSTER SESSION

Efficient Mesh for Driven Cavity Flow	971
N. A. C. Sidik and F. A. Munir	
Study of Flow Behavior in Triangular Cavity	979
N. A. C. Sidik and F. A. Munir	
Development of Ammonium Perchlorate + Aluminum Based Solid Propellant	990
N. Othman and W. K. W. Ali	
Reduction of Time Consumption for Simulating Lid-Driven Cavity Flow Using Lattice Boltzmann Method (LBM)	996
H. M. Faizal and C. S. N. Azwadi	
Virtual Investigation of Free Convection from Concentric Annulus Cylinder by the Finite Difference Lattice Boltzmann Method	1004
O. S. Azmir and C. S. N. Azwadi	
A Study of Transient Flow in a Lid-Driven Square Cavity	1013
O. A. C. Sidik and M. A. N. Mu'tasim	
Design and Fabrication of a 200N Thrust Rocket Motor Based on NH_4ClO_4 + Al + HTPB as Solid Propellant	1019
M. A. Wahid and W. K. W. Ali	
The Cellular Structure of Reacting Fluid	1027
M. A. Wahid, M. Z. A. Faiz, and B. Rosnadiyah	
Stabilization of Reacting Fluid by Bluff Body	1033
M. A. Wahid, M. Z. A. Faiz, and M. N. Norzawani	
Swirling Lean-Premixed Reacting Flow	1042
M. A. Wahid and M. Z. A. Faiz	
Characteristics of Impinging Reacting Flow on Flat Surface	1050
M. A. Wahid, I. M. Taufiq, and A. M. Ibtisham	
Whirling Flames for Fuel Economy and Low NO_x Combustion	1057
K. M. Saqr, M. M. Sies, H. Ujir, and M. A. Wahid	
Comparison Test and Its Evaluation of Flow Meters for Heat Meter	1060
H.-M. Choi, Y.-M. Choi, and B.-R. Yoon	
A Study on the Test Method of the Thermal Mass Flow Meter	1070
Y.-M. Choi and H.-M. Choi	
Secondary Flows in Curved Rectangular Ducts with Diminishing Cross Section	1083
A. N. Darus and Y. Y. Fatt	
Author Index	1098