

25th International Symposium on Air Breathing Engines (ISABE 2022)

Ottawa, Canada
25-30 September 2022

Volume 1 of 3

ISBN: 978-1-7138-7184-2

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.

Copyright© (2022) by International Society for Air Breathing Engines (ISABE)
All rights reserved.

Printed by Curran Associates, Inc. (2023)

For permission requests, please contact International Society for Air Breathing Engines (ISABE)
at the address below.

International Society for Air Breathing Engines (ISABE)
Cranfield University
Bedfordshire, United Kingdom
MK43 0AL

Phone: +44 1234 754765

www.isabe.org

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

TABLE OF CONTENTS

VOLUME 1

Propulsion System Integration for a First Generation Hydrogen Civil Airliner?	1
<i>Jon Huete, Devaiah Nalianda, Pericles Pilidis</i>	
A Hybrid LES/FW-H Simulation for the Fan/compressor Trailing-edge Broadband Noise Reduction with Serrated Configuration	13
<i>Zhang Liangji, Tong Fan, Xiang Kangshen, Chen Weijie, Qiao Weiyang</i>	
Infrared Signal of the Lobed Mixer with External Air Mixing	41
<i>Seong Man Choi, H. S. Jang, H. H. Park</i>	
Receipt Ceramic Material Based on Aluminium Oxide Using Sol-Gel Technology	60
<i>Buriachek Oleg, Zhuravel Vladimir</i>	
A Review of Technologies for the Adjustment of the Leading-Edge of Variable Pitot Inlets for SST	67
<i>Stefan Kazula, Klaus Höschler</i>	
Numerical Investigation of the Breakup Mode and Trajectory of Liquid Jet in a Gaseous Crossflow at Elevated Conditions.....	92
<i>Yu Zhu, Shu Guo, Ruiqiang Bai, Dongbo Yan, Xiaoxiao Sun, Vishal Sethi, Pierre Gauthier</i>	
A Method for Two-Phase Flow Simulation in Engine Performance Tools	113
<i>Martin Obermueller, Dieter Peitsch, Arne Weckend, Holger Schulte</i>	
A Study on the Possibility of the Application of Hybrid Propulsion System Architectures for Military Air Vehicles	130
<i>Stephan G. Scheidler, Moritz G. Kolb</i>	
Numerical Study of Combustor Turbine Interactions Considering a Two Stage High-Pressure Turbine	145
<i>Kenji Miki, Thomas Wey, Jeffrey Moder</i>	
Rotation and Curvature Correction for SST Turbulence Model Applied on the Prediction of Pressure Losses Through Air-Oil Centrifugal Separators for Modern Aero-engines	163
<i>Mariano Di Matteo, Olivier Berten, Patrick Hendrick</i>	
Experimental Investigation on the Influence of the Trailing Edge Shape in a Film Cooled Transonic High Pressure Turbine Cascade	174
<i>Ines Gohl, Martin Bitter, Dragan Kozulovic, Hiroki Sato, Reinhard Niehuis</i>	
Development of a TRL 3 Concept for Variable Pitot Inlets for SST Using a Safe Design Approach.....	189
<i>Stefan Kazula, Klaus Höschler</i>	
Experimental and Numerical Investigation of Mixer Ejector Nozzles for Very Small Turbojet Engines	206
<i>Ralf Schmidt, Andreas Hupfer, Volker Gümmer</i>	
Reflection on the Pitch-Chord and Meanline Radius Ratios in Design and Performance of Centrifugal Turbines.....	220
<i>Liu Yu, Patrick Hendrick, Zheng Ping Zou, Frank Buysschaert</i>	

On the Effect of Inter Compressor Duct Length on Compressor Performance	237
<i>Thomas Dygutsch, Aaron Kasper, Christian Voss</i>	
Design of Sub-Scale Fan for a Boundary Layer Ingestion Test with By-pass	260
<i>Hans Martensson, Marcus Lejon, Debarshee Ghosh, Mikael Åkerberg, Faezeh Rasimarzabadi, Martin Neuteboom</i>	
Conception and Assessment of Test Rig for Characterisation of Air-Oil Heat Exchangers in Oil Systems for Aero Engines	269
<i>Joëlle Vincké, Olivier Berten, Patrick Hendrick</i>	
Experimental Study on Efficiency Enhancement of Tesla Turbine by Cascade Addition	283
<i>Koji Okamoto, Jumpei Nakamura, Kazuo Yamaguchi, Susumu Teramoto</i>	
Aeroengine Transient Performance Simulation Integrated with Generic Heat Soakage and Tip Clearance Model.....	294
<i>Zhuojun Li, Yiguang Li, Suresh Sampath</i>	
Performance Characteristics of Miniature Gas Turbine with a Pulse Combustor.....	319
<i>Takashi Sakurai, Shunsuke Nakamura, Takehiro Sekiguchi, Sora Inoue</i>	
Assessment of the Fluid Network for the Effusion Holes in a RQL (Rich-Burn, Quickquench, Lean-Burn) Gas Turbine Combustor	329
<i>Changju Thomas Wey</i>	
Flame Structure Comparison Using Jet-A and an Isoparaffinic Fuel in a Lean Direct Injection Flame Tube Combustor	357
<i>Yolanda Hicks, Kathleen M. Tacina, Tyler G. Capil</i>	
The Effect of Combustor Inlet Swirl on the Performance of a Micro Gas Turbine.....	373
<i>Sybrand Johannes Van Der Spuy, L. J. Ferreira</i>	
Interactive Learning Platform for Axial Compressor Preliminary Design	386
<i>George Patton De Oliveira Silva, Igor De Oliveira, Cleverson Bringhamti, Jesuino Takachi Tomita</i>	
Experimental Investigation of the Oil Jet Heat Transfer on a Rotating Cylinder for an Aero Engine Gearbox	397
<i>Christian Kromer, Christian Kromer, Emre Ayan, Corina Schwitzke, Hans-Jörg Bauer</i>	
Aerodynamic Loss Generation in a Low-Pressure Turbine Stage with High Lift Blading.....	411
<i>Chunill Hah, James Loellbach</i>	
On the EBC Phase Determination	426
<i>Michael Glavicic, Li Li, Stephanie Gong, Kelly Kranjc</i>	
Jet Engines Performance Accounting	434
<i>Javier Ruiz-Domingo</i>	
Turbofan Transient Heat Transfer Analysis	454
<i>Javier Ruiz-Domingo, Farid Benyoucef</i>	
Redesign of a Micro Turbine for Sub-400N Thrust Class Engines	475
<i>Glen Snedden</i>	
Multi-Domain Conjugate Heat Transfer (CHT) Analysis Using General Grid Interface (GGI).....	493
<i>Farzad Ashrafi, Sri Sreekanth</i>	

Testing a Ceramic Matrix Composite Regenerative Heat Exchanger in a Supersonic Combustor.....	509
<i>Inyoung Yang, Kyung-Jae Lee, Yang-Ji Lee, Sang-Hun Lee, Se-Young Kim</i>	
An Alternative Approach to Evaluate Fuel/Air Mixing Quality	520
<i>Lei-Yong Jiang</i>	
Numerical Analysis of the Influence of Near-Endwall Camber Line Distribution on Leakage Losses of Axial Compressor Shrouded Stators.....	532
<i>Ilaria De Dominicis, Antonija Simunovic, Sebastian Robens, Volker Gümmer</i>	
Enhanced Modeling of Turbulent Decay in Steady State Mixing Plane Simulations.....	542
<i>Alexander Fühling, Nemo Juchmann, Dragan Kozulovic, Christoph Bode, Stephan Behre, Peter Jeschke</i>	
A Mathematical Study of Rotor Thermal Bow in Gas Turbines.....	562
<i>Evan Oscar Smith, Kaisar Al Shami, Andrew Neely</i>	

VOLUME 2

Unsteady Simulations of Migration and Deposition of Fly-Ash Particles in the First-Stage Turbine of an Aero-Engine	574
<i>Zihan Hao, Xing Yang, Zhenping Feng</i>	
Effects of Alternating Elliptical Chamber on Jet Impingement Heat Transfer in Gas Turbine Leading Edge at Different Cross Flow Velocity Ratio	592
<i>Kun Xiao, Juan He, Zhenping Feng</i>	
Towards Quantitative Wall Shear Stress Measurements: Considering the Flow Behavior of Liquid Crystals.....	604
<i>Stefan, O.S.Melekidis, Stefanos Melekidis, Marcus Ebert, Jonas Schmid, Hans-Jörg Bauer</i>	
Comparison of Active Flow Control Measures in an Advanced S-Shaped Engine Intake by Using a Turbo-Compressor.....	620
<i>Philipp Max, Michael Kruppenauer, Marcel Stöbel, Reinhard Niehuis, Dragan Kozulovic</i>	
Effect of Fuels, Aromatics and Preparation Methods on Seal-Swell.....	636
<i>Asnida Anuar, Vamsi Krishna Undavalli, Bhupendra Khandelwal, Simon Blakey</i>	
Multi-Platform App-embedded Model for Hybrid Air-breathing Rocket-cycle Engine in Hypersonic Atmospheric Ascent.....	658
<i>Spyros Tsentis, Vasilis Gkoutzamanis, Aggelos Gaitanis, Anestis Kalfas</i>	
Design and Development of a Variable Area Nozzle for a Test Rig for Fan Intake Interaction	681
<i>Patrick Brunow, Jonas Grubert, Jens Friedrichs, Jens Ortmanns</i>	
Aerodynamic Installation Effects of Over-the-Wing Mounted Ultra-high Bypass Engines.....	699
<i>Vinicius Tavares Silva, Anders Lundbladh, Carlos Xisto</i>	
Conceptual Gas Turbine Design: The Role of Turbine Maps.....	713
<i>Joachim Kurzke</i>	
A Quantum Mechanical Study to Determine the Thermo-Chemistry of the Jet Engine Exhaust Gases in Order to Suppress Contrails	725
<i>Sarah Qureshi, Rumana Qureshii, Azra Yaqub</i>	

Modelling Degradation Mechanisms in Hybrid-Electric Aircraft Propulsion Systems	749
<i>Maximilian Bien, Jan Göing, Jens Friedrichs, Karl Ziaja, Francesca Di Mare, Norman Blanken, Yongtao Cao, Axel Mertens, Bernd Ponick, Lukas Schuchard, Matthias Voigt, Ronald Mailach</i>	
The Numerical Aerodynamic Investigation of Swirling Inlet Flow in a Vaporizer Tube Micro-Gas Turbine Combustor	763
<i>Bronwyn. C. Meyers, Jan-Hendrik Grobler, Glen. C. Snedden</i>	
Interaction of Combined Module Variances and Influence on the Overall Performance of an Turbofan Engine	791
<i>Jan Goeing, Lars Hinz, Sebastian Lueck, Max Bien, Jens Friedrichs</i>	
Experimental Investigation on the Effect of Downstream Casing Coolant Injection on Loss in Linear Turbine Cascade with Tip Clearance	808
<i>Dunam Hong, Seung Jin Song</i>	
Organic Rankine Cycle for Turboprop Engine Application.....	819
<i>Georgios E. Pateropoulos, Theofilos G. Efstathiadis, Anestis I. Kalfas</i>	
Impact of Tank Gravimetric Efficiency on Propulsion System Integration for a First Generation Hydrogen Civil Airliner.....	841
<i>Jon Huete, Devaiah Nalianda, Pericles Pildis</i>	
Effects of a Squealer-Winglet Geometry on the Aerodynamic Performance of a Hydraulic Axial Turbine Used in Turbopumps	850
<i>Daniel Da Silva Tonon, Jesuino Takachi Tomita, Ezio Castejon Garcia, Cleverson Bringhenti, Luiz Eduardo Nunes Almeida</i>	
Estimation of Performance of Turbofan Engine Bay Ventilation and Cooling System	867
<i>Aishwarjya Gogoi, Rohit Vashistha, Himanshu Yadav, G. P. Ravishankar</i>	
Improvements in a Multistage Axial-Flow Compressor Design and Its Operation on a Small Gas Turbine Performance	880
<i>Ruben Bruno Diaz, Jesuino Takachi Tomita, Cleverson Bringhenti, Diogo Ferraz Cavalca</i>	
Design and Development of an Engine Inlet Distortion Measurement	891
<i>Aishwarjya Gogoi, Rohit Vashistha</i>	
Feasibility Study of Engine Bay Ventilation with Intake Air Driven by Ejector Nozzle	901
<i>Abhijit Dhamanekar, Aishwarjya Gogoi</i>	
Sensitivity Study of Engine Design Parameters on Climate Change.....	914
<i>H. S. Saluja, F. Yin, A. Gangoli Rao</i>	
Exploratory Analysis of the Installation Effects in a Propulsive Fuselage	931
<i>Emily Raijmakers, Biagio Della Corte, Arvind Gangoli Rao</i>	
Multidisciplinary Conceptual Design for a Hybrid-Electric Commuter Aircraft	946
<i>Christos P. Nasoulis, Vasilis G. Gkoutzamanis, Anestis I. Kalfas</i>	
Experimental Investigation of the Oil Jet Heat Transfer on Meshing Spur Gears.....	968
<i>Emre Ayan, Christian Kromer, Corina Schwitzke, Hans-Jörg Bauer</i>	

Tensile and Fatigue Performance in Tension-Tension of Additively Manufactured Composite Materials for Engine Applications	981
<i>Julieta Barroeta Robles, Priti Wanjara, Richard G. Cole, Javad Gholipour, Fabian Sanchez, Andrew Spineanu, Anas Chkaifi</i>	
Design and Development of a Combined Intake Fan Test Rig to Enable Investigations of Stable Operating Ranges	986
<i>Jonas Grubert, Lionel Meillard, Peter Winkelmann, Patrick Brunow, Jens Friedrichs, Rainer Schnell, Jens Ortmanns</i>	
Sand Erosion Modeling in Generic Compressor Rig Testing	1003
<i>Lei-Yong Jiang, Xijia Wu, Qi Yang</i>	
Experimental Investigation of Bleed Air Extraction for Different Stator and Stage Setups	1019
<i>Daniel Kessler, Jens Friedrichs, Bernd Becker, Patrick Grothe</i>	
An Altitude Capable Rig for Studying Engine Inlet Velocity Profile Effects Boundary Layer Generator	1031
<i>Faezeh Rasimarzabadi, Catherine Clark, Martin Neuteboom, David Orchard, Hans Martensson</i>	
Investigation of Flow Migration Down- Stream of the Rotor in the Large Scale Turbine Rig Using Foreign Gas Tracing	1050
<i>Hellen Erik N. De Winter, Johannes Eitenmüller, Sebastian Leichtfuß, Heinz-Peter Schiffer, Christoph Lyko, Gregor Schmid</i>	
Design of Porous Media for Optimal Combustion Liner Transpiration Cooling.....	1065
<i>Mathieu Hinse, Mohsen Broumand, Patrick Richer, Bertrand Jodoin, Sean Yun, Zekai Hong</i>	
Platform Leakage and Blade Tilting in Axial Compressor CFD Simulations	1085
<i>Jannik Petermann, Bernd Becker, Volker Gümmer</i>	
Exploring the Operational Strategy of an Electrically-Driven Variable Pitch BLI-Fan.....	1100
<i>Maximilian Mennicken, Rainer Schnell, Max Arzberger</i>	
Studies on an Electric Hybrid Adaptive Cycle Engine	1135
<i>Philipp Jäger, Marcel Stöbel, Michael Krummenauer, Reinhard Niehuis</i>	
Effects of Flame-Flame Interaction on Emission Characteristics in Gas Turbine Combustors	1150
<i>Sanghyeok Kwak, Jaehong Choi, Myungguen Ahn, Seongpil Joo, Min Chul Lee, Youngbin Yoon</i>	

VOLUME 3

Investigation on Flow Interactions in a Contra-Rotating Axial Compressor with Inflow Non-Uniformities.....	1167
<i>Srinivas Prakash Diwanji, A. M. Pradeep</i>	
Effect of Nozzle Chevron Technology on the Near-Field Contrail Properties Behind an Aircraft Engine Using a CFD-microphysics Coupling	1182
<i>Sébastien Cantin, Adrien Misandeau, Mohamed Chouak, François Garnier</i>	
Numerical and Experimental Design of a Radial Displaceable Inlet Distortion Device	1206
<i>Bojan Kajasa, Timea Lengyel- Kampmann, Robert Meyer</i>	

Metal Particle Damper Characteristics for Gas Generator Cycle Air Turbo Ramjet Engine	1222
<i>Ryojiro Minato, Hikaru Sasaki, Daisuke Nakata, Masaharu Uchiumi</i>	
Numerical and Experimental Investigation of Non-Reactive Flow Characteristics of a Multi Swirl Lean Direct Injection Burner	1233
<i>Perikathra Sarath, Raparti Jogesh Aditya, T. M. Muruganandam</i>	
Identification and Classification of Operating Flow Regimes and Prediction of Stall in a Contra- Rotating Axial Fan Using Machine Learning	1246
<i>Akshay Kumar, Akshay Kumar, M. P. Manas, A. M. Pradeep</i>	
Robust Optimization Used in the Redesign of a Low-Speed Compressor Tandem Stator	1267
<i>Samuele Giannini, Mattia Straccia, Volker Gümmer</i>	
A Fast Tool for Prediction of Thermal Mechanical Effects on Turbine Tip Clearance.....	1282
<i>Xiaojian Ma, Theoklis Nikolaidis</i>	
Introduction and Evaluation of an Aerostructural Coupling Approach for the Design of Shape Adaptive Compressor Blading.....	1285
<i>Marcel Seidler, Jens Friedrichs, Zhuzhell Montano Rejas, Johannes Riemenschneider</i>	
Degradation of Turbo-Electric Distributed Propulsion Systems.....	1298
<i>Anmol Midha, Suresh Sampath</i>	
Performance of a Turbojet Engine with Fluidic Thrust Vectoring	1313
<i>Ramraj Harikanth Sundararaj, T. Chandra Sekar, Rajat Arora, Abhijit Kushari</i>	
Numerical Investigation of Flow Characteristics Inside an Exhaust Duct System.....	1336
<i>Sindhuja Priyadarshini, Vinayak S. Kamath, Rajat Arora, Ramraj H Sundararaj, T. Chandra Sekar, Abhijit Kushari</i>	
Near-Stall Modelling of a Pitching Airfoil at High Incidence, Mach Number and Reduced Frequency	1345
<i>Christoph Brandstetter, Sina Stapelfeldt</i>	
On the Loss Behavior of a Split Blade VIGV Configuration at Varied Stagger Angle Combinations	1358
<i>Roman Gawin Frank, Niklas Seer, Hanno Wegner, Reinhard Niehuis</i>	
Highly Accurate Loss Determination at the Large Scale Turbine Rig (LSTR) with Varying Rotor Tip Configurations.....	1372
<i>Johannes Eitenmüller, Sebastian Leichtfuß, Heinz-Peter Schiffer, Christoph Lyko, Gregor Schmid</i>	
Investigation of Damage Behaviour and Response Surface Optimisation of Auxetic Structures for Application in Fan- And Compressor Casings and Containment Layers	1390
<i>Stefan Schröter, Volker Gümmer</i>	
Choosing Propulsion System Composition and Parameters for a Supersonic Cruising Aircraft.....	1405
<i>Mikle Shevchenko, Kislov Oleh, Yurii Ulitenko</i>	
Virtual Gas Turbines: A Novel Flow Network Solver Formulation for the Automated Design- Analysis of Secondary Air System	1422
<i>Davendu Kulkarni, Luca Di Mare</i>	

Comparison of Different CFD Unsteady Methods for the Performance Analysis of a Transonic Axial Compressor.....	1454
<i>Lucilene Moraes Da Silva, Tomas Grönstedt, Luiz Henrique, Lindquist Whitaker, Jesuino Takachi Tomita, Marcelo Assato, Vitor Alexandre Carlesse Martins</i>	
On the Importance of Condensation for the Thermodynamic Cycle of Fuel Cell Turbochargers in Aviation	1472
<i>Tim Wittmann, Sebastian Lück, Tim Hertwig, Jens Friedrichs</i>	
Effects of Bypass Ratio for Civil Turbofans Using Thrust Reversers	1485
<i>Jingjie Huang, Pericles Pilidis</i>	
Improving Adiabatic Film Cooling Effectiveness by Varying the Compound Angles of Effusion Cooling Holes Along Main Flow Direction.....	1497
<i>Yeongmin Pyo, Patrick Richer, Bertrand Jodoin, Sean Yun, Zekai Hong, Mohsen Broumand</i>	
Aeromechanical Optimization of an Axial Compressor Stage	1511
<i>Seif Elmasry, Bernd Beirow, Felix Figaschewsky, Thomas Giersch</i>	
CFD Investigation of Aircraft Propulsion Fire Suppression System	1528
<i>Akhil Dinesh, Suresh Sampath, Michael Diakostefanis</i>	
Streamline-Traced, External-Compression Supersonic Inlets for Mach 2.....	1542
<i>John W Slater</i>	
Turbine Rotor design—3D Stress Analysis Automation	1557
<i>Antoine Desponts, Hany Moustapha, Acher-Igal Abenhaim, Othmane Leghzaoui, Benoit Blondin, Pascal Doran</i>	
Development of Topology Optimization Technique for Air-Cooled Oil Cooler: 3-D Examination Under Laminar Condition.....	1572
<i>Tsukasa Ishii, Toshinori Watanabe, Takehiro Himeno</i>	
Design Optimization of Axial Turbine Disc and Attachment for Aeroengine	1588
<i>Najeh Najeh, Pascal Doran, Benoit Blondin, Hany Moustapha</i>	
Assessment of Weld Manufacturability of Alternative Jet Engine Structural Components Through Digital Experiments.....	1600
<i>Julian Martinsson Bonde, Arindam Brahma, Massimo Panarotto, Ola Isaksson, Timos Kipouros, P. John Clarkson, Jonas Kressin, Petter Andersson</i>	
Low Cycle Fatigue Analysis of Turbine Disc—Implement of Low Cycle Fatigue Analysis on Gas Turbine Discs in Preliminary Design.....	1610
<i>Florence Bérard, Hany Moustapha, Acher-Igal Abenhaim, Pascal Doran, Benoit Blondin</i>	
Aerothermal Analysis of Film Cooling.....	1625
<i>Katharina Stichling, Hans-Jörg Bauer</i>	
Hydrogen Fuel Cells for aviation?—A Potential Analysis Comparing Different Thrust Categories.....	1640
<i>Marc Schmelcher, Jannik Häßy</i>	
Change in Performance and Rotordynamic Characteristics Due to Compressor Fouling in Aero Gas Turbines.....	1666
<i>Cesar Andres Valdes Vasquez, Suresh Sampath</i>	

Assessment of the Effects from the Fuselage Aft-Body Region in a Boundary Layer Ingestion Airframe Concept	1682
<i>Ashik Vincent Palathingal, Jesuino Takachi Tomita, Cornelius Henricus Venner, Cleverson Bringhenti, Fabiola Paula Costa</i>	
Detection and Analysis of Combustion Instabilities in Pre-Cooled Turbojet Engine Model Ram Combustor by Using Autoencoder	1701
<i>Koichi Omi, Kotaro Yoshihara, Daiki Ito, Hideyuki Taguchi, Shinji Nakaya, Mitsuhiro Tsue</i>	
Investigation of a Novel Flow Metric for the Design and Evaluation of Non Axisymmetric Turbine Endwall Contours	1711
<i>Jonathan Olaf Paul Bergh, Glen Snedden</i>	
Development of Test Facility for Hybrid Electric Aviation Propulsion: A Conceptual Review	1731
<i>Doug Marsh, Adam Elliot, Michael Lam, Patrick Sylvain, George Hajecek, Osvaldo Arenas, Shaji Manipurath</i>	
Hydrogen Propulsion for Civil Aviation: An Introduction Scenario	1746
<i>Isidoros Pantelis, Jon Huete, Devaiah Nalianda, Elzbieta Jarzebowska, Pericles Pilidis</i>	

Author Index