

2022 13th International Conference on Mechanical and Aerospace Engineering (ICMAE 2022)

**Bratislava, Slovakia
20-22 July 2022**



**IEEE Catalog Number: CFP22G51-POD
ISBN: 978-1-6654-7236-4**

**Copyright © 2022 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP22G51-POD
ISBN (Print-On-Demand):	978-1-6654-7236-4
ISBN (Online):	978-1-6654-7235-7

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
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

2022 13th International Conference on Mechanical and Aerospace Engineering (ICMAE 2022)

Table of Contents

PREFACE.....	xi
CONFERENCE COMMITTEES.....	xii

➤ **Materials Science and Mechanical Analysis**

Development of β -Ti Alloys for Biomedical Applications – A Review	1
<i>Ahmed Rabeea Hayyawji, Haydar Al-Ethari, Ali Hubi Haleem</i>	
The Effects of Inclination Angle on the Cooling Performance of Fan-Shaped Holes under Different Blowing Ratios	7
<i>Chen Zhou, Liang Ding</i>	
Research on the Surface Integrity and Fatigue Behavior of Grinding Ni-Based Superalloy GH4169DA	13
<i>Xinchun Huang, Kaining Shi, Shangzhe Zheng</i>	
Characterization of Solar Hot Air Balloons with Different Envelope Shapes	21
<i>Kritsadis Amonjanyaporn, Patchalaporn Jiwchuaphan, Raschanon Wattanathanakeat, Pititat Itsariyapinyo</i>	
Research on Solving Ordinary Differential Equations (ODEs) Based on Machine Learning	27
<i>Zhiqiang Lin, Xiang Lyu, Rong Ma</i>	
A Novel Auxetic Honeycomb Cylindrical Structure for Enhanced Energy Absorption	33
<i>Yang Zhou, Yi Pan, Qiang Gao, Beibei Sun</i>	
Study of the Influence of Input Parameters on the Quality of Additively Produced Plastic Components	39
<i>Martin Korol, Jan Vanca, Vidosav Majstorovic, Marek Kocisko, Petr Baron, Jozef Torok, Adrian Vodilka, Simona Hlavata</i>	
Experimental Study on Particle Size Distribution of Aluminum Combustion under Acoustic Oscillation	45
<i>Jiang Yuan, Bingning Jin, Yu Liao, Zhixin-Wang, Lin Gan, Yuanhua Wang, Peijin Liu</i>	
Effect of Wear on the Vibrating Behaviour of the Tool at Turning CW724R Alloy	51
<i>Peter Pavol Monka, Katarina Monkova, George Pantazopoulos, Anagnostis I. Toulfatzis</i>	

Design for Six Sigma: Material Design for 3D Printing of the New Product	56
<i>Kristína Lengyelová, Jone Alberdi</i>	
Solid Particle Erosion Wear Behaviors of Recycled PA 3200 GF Powders Produced by Selective Laser Sintering Method in Different Abrasive Environmental Conditions.....	61
<i>Mehmet Bagci, Musa Demirci, Baris Samim Nesimioglu</i>	
➤ Engine Modeling and Simulation	
The Performance Simulation of the Conversion Process of a Double-Mode Turbo Engine	65
<i>Cheng Ren, Yuchun Chen, Linyuan Jia, Jie Yang</i>	
Modeling and Design of Large Civil Tilt-Rotor Power Plant under Emergency Conditions.....	71
<i>Yulin Qiu, Yuchun Chen, Xinchun Huang, Hanyang Wang, Junyi Yu</i>	
Transient Performance Simulation of Ramjets Considering Volume Effect	76
<i>Ruiyuan Fang, Jie Liu, Yuchun Chen, Keran Song, Zhibin Zhang</i>	
Overall Performance Modeling and Performance Analysis of Hydrogen Precooled Turbine Engine	81
<i>Fanqi Kong, Yuchun Chen, Shangzhe Zheng, Zhennan Zhao</i>	
A New Type Unloading Groove Design and Simulation for Engine Fuel Gear Pump	86
<i>Hongru Liu, Mengni Pan, Jiangfeng Fu, Huacong Li, Rui Cao</i>	
Research on Modeling and Control Strategy of Contra-Rotating Open Rotor Engine	91
<i>Fengping Chen, Yuchun Chen</i>	
Numerical Study on Flow Characteristics of RBCC Inlet during Ejector-to-Ramjet Mode Transition	97
<i>Xue Yang, Yiyang Yang, Fuhao Chen, Menglei Li, Lei Shi</i>	
➤ Control Theory and Control Systems	
Hardware-in-the-Loop Simulation Platform for Fault Diagnosis of Distributed Engine Control System	102
<i>Cansen Wang, Yingqing Guo, Wanli Zhao, Haojie Ying, Kejie Xu</i>	
Passive Flow Control for Heat Flux Reduction on VShaped Blunt Leading Edges	108
<i>Sijia Liu, Dake Kang, Chao Yan, Mao Sun, Zhenhua Jiang</i>	
Model Predictive Control-Based Guidance and Control System for Simultaneous Multi-Satellite Assembly in Proximity Operation.....	114
<i>Mohammed Atallah, Mohamed Okasha, Tarek N. Dief, Farag Omar</i>	
Performance Seeking Control of Variable Cycle Engine Based on SQP.....	125
<i>Hongru Liu, Mengni Pan, Jiangfeng Fu, Xiaobo Zhang</i>	

Design, Implementation and Testing of Operational Modes in ADCS of a CubeSat	130
<i>Abdulrahman Sulaiman, Hamad Shahdad, Ahmed Alghfeli, Omar Alhammadi, Faisal Alothali, Mohammed Atallah, Mohamed Okasha, Abdul-halim Jallad</i>	
Research on Ramjet Modeling for Control and Multivariable Control System Transform.....	138
<i>Huafeng Yu, Yingqing Guo, Xinghui Yan, Jiamei Wang</i>	
Path Following Control of Quadrotors Using Controllers Developed for General Euler-Lagrange Systems	144
<i>Espen Oland, Tom Stian Andersen</i>	
Design of Information System for Advanced Technologies Production Sustainability.....	150
<i>Vidosav Majstorovic, Shufeng Sun, Milena Kubisova, Lucia Knapcikova, Romana Hricova, Jozef Tkac</i>	
➤ Power Machinery and Engineering	
The Effects of Bleed on Acceleration Performance of Turbofan Engine	157
<i>Yu-ru Wang, Yu-chun Chen</i>	
Numerical Study on the Effects of Installation Angle of Blade on Desired Comprehensive Performance of Axial Flow Fan	163
<i>Hu Ding, Jianrun Zhang</i>	
Lubrication Performance Analysis of Fuel Gear Pump Sliding Bearing under High Speed and Wide Temperature Range	168
<i>Kai Wang, Jiangfeng Fu, Shijie Wei, Pengfei Wei, Tong Li, Yao Jiang</i>	
Integrated Design and Verification of Locomotive Traction Gearbox Based on Finite Element Analysis	174
<i>Liang Xuan, Chunfei Zhang, Siyuan Tian, Tianmin Guan, Lei Lei</i>	
Analysis of the Influence Laws of Inlet Condition on the Volumetric Efficiency of the High-Speed Fuel Gear Pump	184
<i>Zhijie Zhao, Jiangfeng Fu, Shijie Wei, Pengfei Wei, Tong Li, Yao Jiang</i>	
Research on Health Estimation Methods for Variable Cycle Engine	190
<i>Hongliang Xiao, Jiangfeng Fu, Hao Chen, Jingjing He</i>	
Structural Design and Verification of Hydrogen Peroxide Electric Pump	195
<i>He Yuanbo, Liu Yang, Wang Jan, Zhang Wei</i>	
Optimization Design for Aerodynamic Noise Reduction of Train Air-Conditioning Axial Fan.....	200
<i>Yunwei Chen, Xi Lu</i>	
➤ Space Power and Propulsion	
Analysis of Scramjet Combustor Based on Constant Mach Number Heating Method.....	205
<i>Jiahui Wang, Chun Guan, Yuchun Chen, Fanqi Kong, Jinfeng Du</i>	

Numerical Investigation of Thermo-Mechanical Behaviour of an Aluminum-Silicon Alloy Piston in an IC Engine.....	210
<i>Shah Nawaz Khan, Ali Usman, Abdel-Hamid Ismail Mourad, Cheol Woo Park, Marcus Liwicki, Andreas Almqvist</i>	
Research on Health Indicators Selection of Civil Turbofan Engine Fuel System	217
<i>Haojie Ying, Yingqing Guo, Wanli Zhao, Cansen Wang</i>	
Simplified Model of Aviation Brake and Wheel Dynamical Characteristics	223
<i>Yingying Wu, Jun Wang, Di Wang, Wenqing Zhao</i>	
Numerical Simulation on Critical Initiation Conditions of Air-Breathing Pulse Detonation Combustor.....	227
<i>Tianyu Sun, Yujia Yang, Wei Fan</i>	
Experimental Study on the Performance of a Rotating Detonation Combustor with Different Outlet Restrictions	233
<i>Zhongtian Jiao, Ke Wang, Zhicheng Wang, Minghao Zhao, Wei Fan</i>	
Aeroelastic Prediction System with Multiinput- Multioutput Characteristics Based on the Gated Recurrent Neural Network	239
<i>Xun Peng, Hao Zhu, Weizong Wang, Xintong Li</i>	
Effect of Dynamic Characteristics of Fuel on Transient Performance of Solid Fuel Ramjets	247
<i>Ruiyuan Fang, Zhibin Zhang, Yuchun Chen, Keran Song, Jie Liu</i>	
Development and Characterization of Porous-Media Borosilicate Glass Ion Sources for Electrospray Thruster	253
<i>Kuan Qiao, Yuntian Yang, Xiaokang Li, Jianjun Wu, Dawei Guo, Mousen Cheng</i>	
A Comparison of the Nonlinear Unsteady Responses of Two Classical Models for Solid Propellant	258
<i>Zhuopu Wang, Xiangyu Zhang, Yanjun Bai, Xiaosong Gan, Jianru Wang, Bingning Jin, Peijin Liu</i>	
➤ Space Power and Rocket Engineering	
Research on the Parametric Solid Modeling Method of Solid Rocket Motor for Multiphysics Simulation	264
<i>Jiaren Ren, Fu-ting Bao, Ran Wei, Lin Dai, Jiandong Zhang</i>	
Simulation of Evaporated-Diffuse Combustion of a Single Micro Aluminum Droplet in Solid Rocket Motor	270
<i>Ruyao Wang, Junwei Li, Xinyuan Zhou, Deyou Wang, Ningfei Wang</i>	
Integrated Optimization Design of Solid Rocket Trajectory / Overall Parameters	278
<i>Yuxiao Deng, Yang Liu, Fang Bian, Zaicheng Chen</i>	
Large-Size Catalytic Bed Performance Study of Hybrid Rocket Motor Based on 98% Hydrogen Peroxide.....	285
<i>Xiangyu Meng, Hui Tian, Ruikai Chen, Zihao Guo, Jihong Shan, Xiaodong Wang</i>	
Numerical Simulation of Three-Dimensional Combustion Flows of Pasty Propellant Rocket Motor	290
<i>Renjie Hu, Weizong Wang</i>	

Modeling, Simulation and Characteristic Analysis of a Liquid-Propellant Rocket Engine Control Valve	296
<i>Hui Li, Yingqing Guo</i>	
Numerical Study on Hybrid Rocket Motor with Wagon Wheel Segmented Rotation Grain	303
<i>Xianzhu Jiang, Hui Tian, Xintong Li, Xiaoting Niu</i>	
Influence of Channel Geometry Micro-Deviation on the Life Prediction of the Reusable Rocket Engine	309
<i>Zhiwei Chen, Ping Jin, Ruizhi Li, Guobiao Cai</i>	
Mixing Performance of Swirler Enhanced Solid Rocket Ramjet.....	314
<i>Yongcheng Tao, Jiming Cheng, Xiping Feng, Desheng He, Zihai Duan</i>	
➤ Aircraft Design and Manufacturing	
Energy Absorbing Materials for Crashworthy Design of Aircraft: A Review	320
<i>Yongjie Zhang, Bo Cui, Zhiwen Li, Tao Jin</i>	
Design Optimization of Low Reynolds Number Airfoil for Enhanced Aerodynamics of 4R-UAV	325
<i>Ali Arshad, Chameera Nawanjana, Vadims Kovalčuks</i>	
Hypersonic Vehicle/Deeply Precooled Combined Cycle Engine Integration Analysis.....	330
<i>Shangzhe Zheng, Yuchun Chen, Jiahui Wang, Zhennan Zhao</i>	
FE Modeling and Analysis Validation of an Adaptive Winglet Structure	336
<i>Lorenzo Pellone, Salvatore Ameduri, Ignazio Dimino, Umberto Mercurio, Antonio Concilio, Michelangelo Giuliani, Vincenzo Capuano</i>	
Fuel Consumption Analysis of Distributed Propulsion.....	342
<i>Xiao-chen Wang, Yu-chun Chen, Yu-ru Wang</i>	
A Model Predictive Control Based Autopilot for Aircraft.....	347
<i>Luke Keating, Dermot Geraghty</i>	
Investigation on Length Effect of Seals between Inboard Flap and Outboard Flap of a Civil Aircraft	352
<i>Mengying Chen, Longqian Zheng, Dongyun Zhang, Bo Wang</i>	
Large Civil Aircraft Nonlinear Flight Dynamics Iteration Trim Method Based on the Downhill Simplex Optimization Algorithm	358
<i>Yuhong Cai, Zhiyan Yang, Rui Zhang, Duoqia Huang, Dong Wu, Mailiang Li</i>	
➤ Mechanical and Electronic Engineering	
Battery and Solar Array Sizing for Electro-Optic and Radar Remote Sensing Satellites – A Detail Procedure.....	365
<i>Nguyen Van Truong, Pham Duc Toan, Do Manh Hung, Phung Duc Minh</i>	

Designing and Modeling of Airborne Wind Energy System	372
<i>Adnan Adnan, Sikandar Khan</i>	
Comparison of the Dynamic Characteristics of Electric Pump and Pressure-fed Systems for Space Engines	377
<i>Chuang Zhou, Nanjia Yu, Jue Wang, Tianwen Li, Jiangning Wang, Haoran Shi</i>	
Numerical Simulations of Vortex-Acoustic Coupling in Two-Phase Flow of VKI Motor	384
<i>Chao Huo, Tengfei Luo, Peijin Liu</i>	
A Preliminary Research on Space Situational Awareness Based on Event Cameras	390
<i>Kun Xiao, Pengju Li, Guohui Wang, Zhi Li, Yi Chen, Yongfeng Xie, Yuqiang Fang</i>	
The Effect of Reynolds Number in Compressible Channel Flow	396
<i>Rui Ma, Zheng-hong Gao, Shu-sheng Chen</i>	
A Novel Approximate Analysis of the Jump Points and Global Stability of the Duffing Oscillator	402
<i>Lin Chen, Beibei Sun, Guofeng Xia, Xin Liao, Jianwei Wu</i>	
Nonlinear Acoustic Oscillation Analysis Method Based on Improved Variational Mode Decomposition	408
<i>Bingning Jin, Lin Gan, Yanjun Bai, Xiangyu Zhan, Shaojuan Wei, Zhuopu Wang, Peijin Liu</i>	
Investigation of Afterburning Effects on the Thermal Environment of Methane Rocket at Different Altitudes	414
<i>Bing Liu, Chenglong Xing, Guigao Le, Ping Dong, Ke Liu</i>	
Review of Calibration Methods for Asteroid Optical Cameras	421
<i>Yuehan An, Yanpeng Wu, Fenzhi Wu, Lin Li, Xiao Liang, Yunfan Lei</i>	
➤ Aerospace Systems and Management Technology	
Three-Level Mega Satellite Constellation Backup Strategy	431
<i>Luo Tiansu, Bian Xiaolong, Feng Yunwen, Xue Xiaofeng</i>	
Two-Stage Key Frame Extraction Technology for Aerial Video Image Mosaic Based on Expected Point Pair and Navigation Information Fusion	437
<i>Yongji Zheng, Yanwei Chen, Zhiguang Yu</i>	
Wall Catalytic Effects on Aerodynamics of the Mars Entry Capsule	443
<i>Kang Zhong, Hongfeng Zhao, Zeng Xu, Fei Zhang, Wei Zhao</i>	
Precision Analysis and Evaluation of BDS Real-time Precise Point Positioning	448
<i>Xiangyang Han, Wanlin Zhao, Ya Cui, Yijin Chen</i>	
Trajectory Design of Asteroid (469219) Probe with Low-Thrust	453
<i>Xiaodie Wei, Danhe Chen, Olga Starinova, Xiang Zhang</i>	

Research on the Efficiency Factors Affecting Airport Security Check Based on Intelligent Passenger Security Check Equipment	459
<i>Bo Li, Yupeng Jia, Chengxue Jin</i>	
STPA Analysis over the Earlier Phases of Brazilian Aerospace Products Life Cycle Using OPM	465
<i>Guilherme Moreira, Daniel Rondon Pleffken, Christopher Cerqueira, Willer Santos</i>	
➤ Mechanical Design and Manufacturing Engineering	
Optimization of a Double Wishbone Suspension Geometry for Off-Road Vehicles Using Genetic Algorithm and Machine Learning	472
<i>Shaswat Garg, Satwik Dudeja, Satwik Gupta, Vikas Rastogi</i>	
Mathematically Simulated Conventional Measurement of Spur Gear Tooth Thickness Using 3D Reconstruction	478
<i>Heba Shalaby, Abdallah Khalil, Mohamed Damir</i>	
Design and Manufacture of Solar Hot Air Balloons with Different Envelope Shapes	484
<i>Kasama Korawutwiwat, Phitchaya Sukchai, Pititit Itsariyapinyo</i>	
Fault Diagnosis for Hydraulic Loading System of Altitude Simulation Test Facility Based on Multichannel 1D-CNN	490
<i>Pengfei Guo, Jin Peng, Wanli Zhao, Xinyu Diao, Xinyu Diao</i>	
Temperature Field Simulation of Asphalt Heating Furnace	496
<i>Jiankui Dang, Rongyu Ge, Xiuli Fu, Liwen Chen</i>	
An Evaluation Method in Large Luxury Cruise Ship Design and Construction Challenges Based on Analytic Hierarchy Process	501
<i>Yongjie Zhan, Yuefan Jiang, Yongqi Zeng, Kang Cao, Yongwen Huang</i>	
Using Grey Relation Analysis to Improve Tool Life in Medium Carbon Steel Turning by Coating Multilayer HSS Insert	507
<i>Wurood Asaad M, Haydar Al-Ethari, Shaimaa J. Kareem</i>	
Construction and Application of NLP-Based Knowledge Graph in CNC Equipment Fault Field	514
<i>Qian Zhao, Rui Wang, Peng Xu, Wei Yang</i>	
Including Geometrical Tolerances in Concurrent Process Tolerance Allocation of Mechanical Assemblies	520
<i>Heping Peng, Zhuoqun Peng</i>	
Investigation of the Influence of Orientation on the Tensile Properties of 3D Printed Samples with Gyroid Structure	526
<i>Ján Vanca, Katarina Monkova, Milan Žaludek, Peter Pavol Monka, Martin Korol', Drazan Kozak, Pavel Beno, Fateh Ferroudji</i>	

Discrete Event Simulation in Support of Optimized Automotive Assembly Line Producing Bullet Proof Vehicles Having Tailor Welded Blanks..... 532

Usman Attique, Shahid Ikramullah Butt, Shahid Rashid, Qasim Zeeshan