

*Proceedings of the ASME*

**INTERNATIONAL MECHANICAL ENGINEERING  
CONGRESS AND EXPOSITION  
- 2019 -**

---

**VOLUME 1  
ADVANCES IN AEROSPACE TECHNOLOGY**

presented at  
ASME 2019 INTERNATIONAL MECHANICAL ENGINEERING CONGRESS AND EXPOSITION  
NOVEMBER 11-14, 2019  
SALT LAKE CITY, UTAH, USA

sponsored by  
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](mailto:permissions@asme.org).

**ISBN NO. 978-0-7918-5936-0**

**© 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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## CONTENTS

### ADVANCES IN AEROSPACE TECHNOLOGY

#### ADVANCES IN AERODYNAMICS

**IMECE2019-10460..... V001T03A001**

Low-Cost Particulate Detection in Bleed Air

*Mir Seliman Waez, Steven J. Eckels, Christopher M. Sorensen*

**IMECE2019-11047..... V001T03A002**

Investigations of Three-Dimensional Flow Field Development in an Axial Compressor Cascade

*Saeed A. El-Shahat, Hesham M. El-Batsh, Ali M. A. Attia, Guojun Li, Lei Fu*

**IMECE2019-11515..... V001T03A003**

Plasma Actuators Optimization Using Stair Shaped Dielectric Layers

*F. F. Rodrigues, J. Pascoa Marques, M. Trancossi*

#### ADVANCES IN AEROSPACE STRUCTURES AND MATERIALS

**IMECE2019-10142..... V001T03A004**

Effect of Shear Overloads on Crack Propagation in Al-7075 Under In-Plane Biaxial Fatigue Loading

*Abhay K. Singh, Siddhant Datta, Aditi Chattopadhyay, Nam Phan*

**IMECE2019-10480..... V001T03A005**

X-Ray Induced Acoustic Computed Tomography for Non-Destructive Testing of Aircraft Structure

*Tiffany Tran, Pratik Samant, Liangzhong Xiang, Yingtao Liu*

**IMECE2019-10492..... V001T03A006**

A Biaxial Infrared and Geomagnetic Composite Attitude Measurement Method of Rotating Projectile

*Yihan Cao, Xiong Zhu Bu, Wei Han, Zilu He*

**IMECE2019-10577..... V001T03A007**

Structural and Thermal Loads for Hypersonic HEXAFLY-INT Vehicle

*D. Cristillo, R. Scigliano, S. Di Benedetto, S. Cardone, M. Appolloni, A. Jasko*

**IMECE2019-10713..... V001T03A008**

Robust Design of a Test Bench for PHM Study of Ball Screw Drives

*A. C. Bertolino, A. De Martin, G. Jacazio, S. Mauro, M. Sorli*

**IMECE2019-10931..... V001T03A009**

Effect of Cryogenic Temperature Rolling on High Speed Impact Behavior of AA 6082

Thin Targets

*Rahul Dubey, Raja Allavikutty, R. Velmurugan, R. Jayaganthan*

**IMECE2019-11129..... V001T03A010**

Neural Network Inverse Based Omnidirectional Rotation Decoupling Control to the  
Electrodynamic Reaction Sphere

*Zhouyu Huai, Ming Zhang, Yu Zhu, Anlin Chen, Xin Li, Leijie Wang*

**IMECE2019-11544..... V001T03A011**

Numerical Study of the Percussive Riveting Process: Initial Results

*Sai C. Krovvidi, M. Ramulu, Per G. Reinhall*

## **BEAM, PLATE, AND SHELL STRUCTURES**

**IMECE2019-10019..... V001T03A012**

Analytical and Numerical Modelling of Sheet Plate Cold Expanded Hole Subjected to  
Reverse Yielding

*Abdel-Hakim Bouzid, Hacene Touahri*

**IMECE2019-11467..... V001T03A013**

Optimization of 3D Printed Elastomeric Nanocomposites for Flexible Strain Sensing  
Applications

*Mohammad Abshirini, Mohammad Charara, Mrinal C. Saha, M. Cengiz Altan, Yingtao Liu*

**IMECE2019-11723..... V001T03A014**

Fatigue Modeling of Friction-Stir-Welded (FSW) Butt-Joints for Aerospace  
Applications

*Muhammad A. Wahab, Vinay Raghuram*

## **COMPUTATIONAL AEROSPACE STRUCTURAL DYNAMICS AND AEROELASTICITY**

**IMECE2019-10274..... V001T03A015**

A Semi-Empirical Approach to Determine Dynamic Stability of In-Flight Morphing  
Platforms

*Timothy Marchelli, Nesrin Sarigul-Klijn*

**IMECE2019-10531..... V001T03A016**

Computational Design of Microstructures With Stochastic Property Closures  
*Pinar Acar*

**IMECE2019-10958..... V001T03A017**

Optimization of Machining Parameters During Turning of Tungsten Heavy Alloys  
Using Taguchi Analysis

*Chithajalu Kiran Sagar, Amrita Priyadarshini, Amit Kumar Gupta*

**IMECE2019-11333..... V001T03A018**

Parametric Data-Driven Reduced Order Models With State Consistency for  
Aeroelastic Analysis

*William C. Krolick, Yi Wang, Kapil Pant*

**IMECE2019-11483.....** **V001T03A019**  
Aeroelastic Modeling and Analysis of High Aspect Ratio Wings With Different Fidelity  
Structural Models  
*Gokcen Cicek, Altan Kayran*

## DYNAMIC BEHAVIOR OF COMPOSITES

**IMECE2019-10070.....** **V001T03A020**  
Effect of Property of Interphase Layer on Damping Properties of Polymer Composites  
Using Sensitivity Analysis  
*Shank S. Kulkarni, Alireza Tabarraei, Pratik Ghag*

## DYNAMICS AND CONTROL OF AEROSPACE STRUCTURES

**IMECE2019-10948.....** **V001T03A021**  
An Inertial / Altimetric / Infrared / Geomagnetic Integrated Navigation Method for  
Unmanned Aerial Vehicles  
*Zilu He, Xiongzhu Bu, Yihan Cao, Miaomiao Xu*

**IMECE2019-11084.....** **V001T03A022**  
A Case Study of the Unsteady Response of a Hingeless Helicopter Rotor Blade  
*Pratik Sarker, Uttam K. Chakravarty*

**IMECE2019-11087.....** **V001T03A023**  
Thermal Behavior and Melt-Pool Dynamics of Cu-Cr-Zr Alloy in Powder-Bed Selective  
Laser Melting Process  
*M. Shafiqur Rahman, Paul J. Schilling, Paul D. Herrington, Uttam K. Chakravarty*

**IMECE2019-11455.....** **V001T03A024**  
An Analysis of the Aerodynamic Response of an Electroactive Membrane  
*Mohammad Khairul Habib Pulok, Pratik Sarker, Uttam K. Chakravarty*

**IMECE2019-11477.....** **V001T03A025**  
A Study of the Aerodynamics of a Helicopter Rotor Blade  
*Mohammad Khairul Habib Pulok, Uttam K. Chakravarty*

**IMECE2019-11581.....** **V001T03A026**  
Characterizations of the Paper-Based Microfluidic Devices Used for Detecting  
Fentanyl and Related Synthetic Opioids  
*M. Shafiqur Rahman, Uttam K. Chakravarty*

## IMPACT, DAMAGE, AND FRACTURE OF COMPOSITE STRUCTURES

**IMECE2019-10387.....** **V001T03A027**  
Composite Overwrapped Pipe Burst Test: Modeling and Experimentation  
*Andrew Littlefield, Lucas Smith, Michael Macri, Joshua Root*

**IMECE2019-11037.....** **V001T03A028**  
On the Role of Segmentation in the Analysis of Micro-CT Data of Impact Damage in  
the CFRP Composites  
*Olesya I. Zhupanska*

**IMECE2019-12221.....** **V001T03A029**  
Effects of Absorbed Moisture Content on the Impact Response of Specially-  
Orthotropic Composite Plates  
*Furqan Ahmad, Fethi Abbassi, Sajjad Miran*

## LIGHTWEIGHT SANDWICH COMPOSITES AND LAYERED STRUCTURES

**IMECE2019-10296.....** **V001T03A030**  
Best Structural Theories for Free Vibrations of Sandwich Composites via Machine  
Learning  
*Marco Petrolo, Erasmo Carrera*

**IMECE2019-11153.....** **V001T03A031**  
Comparative Structural Optimization Study of Composite and Aluminum Horizontal  
Tail Plane of a Helicopter  
*Bertan Arpaciglu, Altan Kayran*

## NONLINEAR PROBLEMS IN AEROSPACE STRUCTURES

**IMECE2019-10827.....** **V001T03A032**  
Fast Colored Point Feature Histograms Global Registration  
*Xingjie Liu, Guolei Wang, Simin Zhang, Ken Chen*

**IMECE2019-11364.....** **V001T03A033**  
Large-Deformation Analysis of Elastomeric Structures by Carrera Unified Formulation  
*E. Carrera, A. Pagani, B. Wu, M. Filippi*

**IMECE2019-11377.....** **V001T03A034**  
Mapping the Potential for Infectious Disease Transmission in a Wide-Body Aircraft  
Cabin  
*Seif Mahmoud, James S. Bennett, Mohammad H. Hosni, Byron Jones*

## NOVEL AEROSPACE PROPULSION SYSTEMS

**IMECE2019-11229.....** **V001T03A035**  
Influence of Fuel on a Valveless Pulsejet Engine Performance and Pollutant  
Emissions  
*Andreia Melo, Francisco Brojo*

**IMECE2019-11712.....** **V001T03A036**  
Flow Modelling of Propulsion Nozzles for Nano-Satellites  
*Jose Pascoa Marques, Gustavo Ribeiro, Francisco Brojo*

**IMECE2019-11968.....** **V001T03A037**  
Mechanical Design of Distributed Solar Sail Deployment Systems  
*Ni Li, Salla Kim, Jason Lin, Benjamin De La Torre, Manhong Wong, He Shen, Vimal Patel*

## **PERIDYNAMICS MODELING**

**IMECE2019-11691..... V001T03A038**

Structural Dynamic Testing Results for Air-Independent Proton Exchange Membrane (PEM) Fuel Cell Technologies for Space Applications

*Ryan P. Gilligan, Ian J. Jakupca, Phillip J. Smith, William R. Bennett, Monica C. Guzik, Henry Kacher*

## **STRUCTURAL HEALTH MONITORING OF COMPOSITE MATERIALS AND STRUCTURES**

**IMECE2019-10717..... V001T03A039**

Cure Monitoring of Adhesive for Composite/Metal Bonded Structure Based on Highly Nonlinear Solitary Waves

*Wu Bin, Li Mingzhi, Liu Xiucheng, Wang Heying, He Cunfu, Liu Zongfa*