

IAF Materials and Structures Symposium

Held at the 75th International Astronautical Congress
(IAC 2024)

Milan, Italy
14-18 October 2024

Volume 1 of 2

ISBN: 979-8-3313-1220-6

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© (2024) by International Astronautical Federation
All rights reserved.

Printed with permission by Curran Associates, Inc. (2025)

For permission requests, please contact International Astronautical Federation
at the address below.

International Astronautical Federation
100 Avenue de Suffren
75015 Paris
France

Phone: +33 1 45 67 42 60
Fax: +33 1 42 73 21 20

www.iafastro.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

SPACE STRUCTURES I DESIGN, DEVELOPMENT AND VERIFICATION (LAUNCH VEHICLES AND SPACE VEHICLES, INCLUDING THEIR MECHANICAL/THERMAL/FLUIDIC SYSTEMS)

Enhancing Crashworthiness of Legged-Type Lander Honeycomb Buffers Under Low-Velocity Impacts Through Machine Learning Framework	1
<i>Bianca Omede', Antonio Grande</i>	
Prediction of Thermo-Mechanical State of Reentry Capsule Based on Limited Sensors.....	13
<i>Xiao-Bing Ma, Jiaxin Hu, Rui Guo, Jian-Jun Gou, Chunlin Gong</i>	
Development of Non-Detonic Separation System – Verification of Release Delay-Time Effect on Lv Structures	17
<i>Marco Ancillai, Alessandro Clementi, Giovanni P. Iacomini, Stefano Urbani, Antonio Zallo</i>	
Numerical Study of Vibration Fatigue Failure for Pipeline Welded Structure in Liquid Rocket Engines	25
<i>Hanyang Shi, Qingcheng Zhu, Junjie Lv, Wang Jun, Dahua Du, Binchao Li, Ping Jin</i>	
Development and Testing of a Thrust Vector Control System for a Hybrid Rocket Engine.....	34
<i>Olexiy Shynkarenko, Artur Bertoldi, Jungpyo Lee, Patrick C. Melo</i>	
Enhancing the Natural Frequency of Thai Space Consortium-1 Satellite (TSC-1) by Performing an Analysis of Different Structural Configurations and Materials	48
<i>Wichayuth Klankla, Anuphong Sangthon</i>	
An Evaluation of Composite Primary Structure for Habitat Modules.....	55
<i>Matthew Ziglar, Tin Luu, Bennett Torrance</i>	
Homeostatic Inflatable Decentralized Autonomous Structures: Intelligent Space Structure using Inflatable Structure and Decentralized Autonomy.....	61
<i>Shinichi Kimura, Yoshino Sakuraba, Maiko Yamashita, Satomi Okayama, Jun Koyanagi, Ryo Higuchi, Takahira Aoki</i>	
STEA: A Novel Tool for Space Thermal Environment Assessment.....	65
<i>Enrico Friso, Lorenzo Rabagliati</i>	

SPACE STRUCTURES II DEVELOPMENT AND VERIFICATION (ORBITAL DEPLOYABLE AND DIMENSIONALLY STABLE STRUCTURES, INCLUDING MECHANICAL AND ROBOTIC SYSTEMS AND SUBSYSTEMS)

Design and Optimize of Soft Robotic Manipulator Based on Cable-Driven Bellows Structure	71
<i>Rui Lin, Xiang Zhang, Ming Xu, Teng Yi</i>	
Design of Bistable Deployable Booms using Non-Dominated Sorting Algorithm	83
<i>Flavia Palmeri, Susanna Laurenzi</i>	

Membrane Reflectarray Antenna Design Deployed on Small Satellites using Composite Booms	94
<i>Hiraku Sakamoto, Takashi Tomura, Soma Saito, Gen Nakayama, Haruki Kurokawa, Atsuki Ochi, Koichi Kidani, Kota Toyoda, Mitsuhiro Yasuhara, So Y. Suk, Koudai Suzuki, Riku Maeda, Sota Kume, Ryosuke Sakurai, Kouki Aomi, Kota Kishimoto, Renshi Funabiki, Eri Yoshinaga, Hinata Ishikawa, Takuma Komaba, So Tanaka, Kosei Kikuchi, Boyu Zhang, Tomohiko Sashimura, Motoki Moritani, Delburg Mitchao, Atsushi Shirane, Kenichi Okada</i>	
Implicit Vs Explicit Nonlinear Dynamics for the Unfolding of Deployable Space Structures using Advanced One-Dimensional Finite Elements.....	102
<i>Riccardo Augello, Sergio Pellegrino, Erasmo Carrera</i>	
Dynamic Modeling and Analysis of Deployable Telescope Tubular Mast (TTM) in Spacecraft Systems using Hybrid Coordinate and Kane's Methods.....	109
<i>Tongtong Sun, David P. Madonna, Paolo Gasbarri, Federica Angeletti, Marco Sabatini, Lin Du, Zichen Deng</i>	
Failure Onset Evaluation of Deployable Rolled-Up Composite Synthetic Aperture Radar (DERAC-SAR) Antenna via Global/Local Approach	123
<i>Alfonso Pagani, Karim A. Salem, Annalisa Tresoldi, Jason Shore, Guglielmo Aglietti, Erasmo Carrera</i>	
Deployment and Reachability Analysis of Tendon-Actuated Structural Modules for an In-Space Assembled Segmented Reflector.....	129
<i>Nate Osikowicz, Puneet Singla</i>	
Deployment Mechanism Design for Atmospheric Reentry Protection Systems	143
<i>Pedro Alves, Manuel N. D. B. Júnior, William Silva, Cristian Vendittozzi, Artem Andrianov, Maria F. De Sousa Pimentel, Gustavo Malta, Ignazio Dimino</i>	
New Configuration Optimization Algorithm for Reconfiguration Space Manipulator Based on Generalized Flexibility Index	159
<i>Ying Tian, Yinghong Jia</i>	
Co-Design Robots and Structures Framework for Automated Construction of Modular Space Platforms	165
<i>Mathieu Rognant, Alexandre Albore, Nicolas Piet, Cédric Julien</i>	
<u>SPACE STRUCTURES III DESIGN, DEVELOPMENT AND VERIFICATION (ORBITAL INFRASTRUCTURE FOR IN ORBIT SERVICE & MANUFACTURING, ROBOTIC AND MECHATRONIC SYSTEMS, INCLUDING THEIR MECHANICAL/THERMAL/ FLUIDIC SYSTEMS)</u>	
3D-Printing Mechatronics Components for Reconfigurable Robotics.....	176
<i>Kevin Sankar, Xavier Walls, Alex Ellery</i>	
Study on Microsatellite Structure to Mitigate Mechanical Environment	189
<i>Kentaro Shirai, Hironori Sahara</i>	
Morphology and Behavior Co-Optimization of Modular Satellites for Attitude Control.....	194
<i>Yuxing Wang, Jie Li, Cong Yu, Xinyang Li, Simeng Huang, Yongzhe Chang, Xueqian Wang, Bin Liang</i>	
Design of Robotic Arms with Smart End-Effectors for In-Orbit Assembly and Dis-Assembly.....	204
<i>Yun-Hang Cho, Joshua Glynn</i>	

Enabling Robotic Grasping in Space: Preliminary Performance Evaluation in Space-Like Environment of Adaptronics' Electro-Adhesive Technology	212
<i>Francesca Giardina, Riccardo Mazzotti, Camilla Conti, Rocco Verthechy, Lorenzo Agostini</i>	
Experimental Analysis of a Space Re-Entry Vehicle at Landing Conditions	220
<i>Nicolina Montella, Gareth A. Vio, Luigi Iuspa, Andrea Arovitola, Giuseppe Pezzella, Antonio Viviani</i>	
Piezoelectric Sensor System for Structural Health Monitoring of Spacecraft Docking	231
<i>Lukas Peterson, Andrei Zagrai</i>	
Generative In-Space Manufacturing of Large Space Structures using Fibre-Reinforced Photopolymers.....	238
<i>Jannik Pimpi, Michael Kringer, Thomas Sinn, Markus Pietras</i>	
Technology Demonstrator for Infinite Length On-Orbit Printing (iLOOP)	249
<i>Aditya Thakur, Moritz Förster, Lukas Nolte, Simon Buchholz, Juntang Yang, Declan Jonckers, Simona Silvestri</i>	
Experiment-Based Performance Analysis of the Motion Suspension System for Space Robot Testing	256
<i>Ferdinand Elhardt, Andreas Stemmer, Anton Shu, Marco De Stefano, Manfred Schedl, Maximo A. Roa, Tobias Bruckmann</i>	

SPACE STRUCTURES CONTROL, DYNAMICS AND MICRODYNAMICS

Space Circuitry Tunable Mass Damper Design Parameters Sensitivity Analysis.....	265
<i>Manuele Laurenzi, Riccardo Monti, Walter D'Ambrogio, Marco Tozzi, Marco Salvadei, Jacopo Brunetti</i>	
On the Impact of Gravity During the Micro-Vibration Characterization of Reaction-Wheels: An Experimental Assessment.....	280
<i>Matias B. Körner</i>	
Multibody Simulations and Impact Tests of a Docking System for Small Satellites.....	292
<i>Martina Imperatrice, Alex Caon, Luca Lion, Gianmarco Girardi, Mattia Peruffo, Lorenzo Olivieri, Francesco Sansone, Francesco Branz, Alessandro Francesconi</i>	
Design and Analysis of Multiple Competing "Inertial Morphing" Control Schemes for Autonomous Spinning Spacecraft, Enabling Attitude Acrobatics with Aimed Agility	302
<i>Pavel M. Trivailo, Hirohisa Kojima</i>	
Modeling and Control of an Earth Observation Satellite Equipped with a Spinning Flexible Antenna	320
<i>David P. Madonna, Paolo Gasbarri, Federica Angeletti, Marco Sabatini, Mauro Pontani, David E. Pratesi, Fabrizio Gennari, Luigi Scialanga, Andrea Marchetti</i>	
Investigating Shock Propagation Through Composite Structures	333
<i>Ada Ranieri, Simone De Carolis, Leonardo Soria, Michele Dassisti, Maria Cinefra</i>	
Simulation and Experimental Investigation of CALLISTO's Landing Leg Deployment Dynamics.....	340
<i>Anton Schneider, Jan Bertram, Silvio Schröder, Lars Witte</i>	

Design, Validation and Production of Small-Size Rover Elastic Wheels: A Solution to Plastic Deformations.....	346
<i>Mattia Trentini, Giulio Candita, Leonardo M. Festa, Amalia Dellacasa, Alfonso Pagani, Fabrizio Stesina</i>	
Nash Equilibrium-Based Vibration Control for Large Flexible Space Structures using Distributed Control Moment Gyroscopes.....	353
<i>Tingxiang Zhang, Xiangdong Liu, Xiaoyu Lang</i>	
Using Genetic Algorithm to Characterize Dynamic Joint Parameters of SSRMS.....	360
<i>Sarah Halabieh, George Yang, Paul Grouchy</i>	
Characterization of a Novel Micro-Vibration Mitigation Developed for an Experimental Life Sciences Cube Used at the International Space Station.....	368
<i>Saban Otenkaya, Ali Ozdemir, Dogukan Parlak, Berat Z. Haznedaroglu</i>	
MetOp-SG MicroWave Imager Instrument Microvibration Campaign.....	375
<i>Claudio Maini, Alessandro P. Moroni, Tito Lupi, Andrea Di Cintio, Fabio Tominetti, Luca S. Drioli, Giorgio Parzianello, Geert Smet, Florian Vidal-Mata</i>	

SPACE STRUCTURES AND MATERIALS FOR EXTREME ENVIRONMENT (HIGH-TEMPERATURE AND CRYOGENIC-TEMPERATURE APPLICATIONS INCLUDING THERMAL INSULATION CONCEPTS)

Keynote: Paolo Santini Memorial Lecture - In Space Manufacturing and Extraterrestrial Construction - How Did We Get Here? - Where Are We? - Where Should We Be Going? - THE CHALLENGE: Will We Be Ready?.....	387
<i>Raymond G. Clinton</i>	
Advanced Oxide Ceramic Matrix Composite Inlet with Deployable Flap for Re-Entry Environments.....	424
<i>Valerie L. C. Dosch</i>	
Multi-Plateau Auxetic Metamaterials Constructed by Intracellular and Intercellular Gradients for Energy Absorption in Space	437
<i>Changfang Zhao, Changqing Chen</i>	
Material Characterization and Plasma Testing for an Inflatable Heatshield for the EARS Reusable Smallsat Platform	446
<i>Simone Del Monte, Helber Bernd, Amandine Denis, Diana Martins, Francesco Barato, Gabriele De Zaiacomo, Lorenzo Gerolin, Jaime Gutierrez-Briceno, Arnas Kazakevicius, Paulius Kirstukas, Fabiana Milza, Raquel Marey, Giovanni Medici, Valentina Raimondi, Stefano Pelli, Sergio B. Ricciarini, Giovanni Scirè</i>	
The Aurora Configuration of SCIROCCO Plasma Wind Tunnel for Experiments at Super-Orbital Re-Entry Conditions.....	458
<i>Eduardo Trifoni, Carlo Purpura</i>	
Metamaterial Design and Manufacturing Technologies for Extreme Environment Applications	467
<i>Pengfei Wang</i>	
The Fatigue Performance Study of a Leading Edge Under High Temperature	472
<i>Liqiang Ai, Chen Haipeng, Xiaowei Wang, Rong Chen, Mingyue Lin, Hang Zhao, Jian-Jun Gou</i>	

Multilayer Anisotropic Heat Shield: Analysis of the Structure and Thermal Stress State in Case of a Lunar Probe Re-Entry Module	480
<i>Victor Leonov, Vladimir Zarubin</i>	
Joining of C/C-SiC Ceramic Matrix Composites to High-Entropy Alloys using Cobalt-Based Fillers for In-Space Applications	485
<i>Ebrar Ekiz</i>	
Numerical Study of Thermal Anisotropy and Lay-Up Configuration on Defect Detection in Composite Plate using Lock-In Thermography Test	495
<i>Sidra Riaz</i>	

SPACE ENVIRONMENTAL EFFECTS AND SPACECRAFT PROTECTION

Development of Poly(vinyl Alcohol) Organogels Crosslinked by Boric Acid for Radiation Protection in Space	505
<i>Lucia Lambertini, M. Gabriella Santonicola, Susanna Laurenzi</i>	
Designing Magnetic Shielding for Space Applications using Spray Coating Technology	515
<i>Peter Koss, Stephan Busch, Martin Schimmerohn, Benedikt Schug, Jan Konanz, Rafael Nunes</i>	
Radiation Environment and Effect Analysis of the Zodiac Pioneer Mission.....	519
<i>Eleonora Vacca, Sarah Azimi, Luca Sterpone, Margherita Cardi, Isabella Pappagallo, Paolo Martino</i>	
Advancing Habitability Properties in Space: Shielding Against Cosmic Radiation with Polymer-Based Materials and Beyond	527
<i>Erika Velio, Esteban Décline</i>	
Nanosilica-Based Composites for Space Durability.....	549
<i>Emanuela P. Mancini, Flavia Palmeri, Daniele Tortorici, Lorenzo Martinazzoli, Susanna Laurenzi</i>	
Atomic Oxygen and UV Radiation Synergistic Ageing Effects on Solar Arrays of Sapienza University of Rome LEDSAT Cubesat.....	560
<i>Andrea Delfini, Paolo Marzioli, Lorenzo Frezza, Roberto Pastore, Michela Boscia, Fabio Santoni</i>	

MANUFACTURING AND INDUSTRIALIZATION FOR LAUNCH VEHICLE AND SPACE VEHICLE STRUCTURES AND COMPONENTS (HIGH VOLUME PRODUCTION, INDUSTRIALIZATION, AUTOMATIZATION AND DIGITALIZATION)

KEYNOTE: Automation and Digitalization for Advanced Manufacturing and Launchers Industrialization	567
<i>Jean M. Guimard, Guy Larnac</i>	
A General Framework for the Integration of Industry 4.0 Methodologies into the Manufacturing, Assembly, Integration, and Testing Processes of the Space Industry	575
<i>Marco Eugeni, Alberto Boschetto, Francesco Costantino, Federica Conti, Antonio Culla, Annalisa Fregolent, Luca Lampani, Cristina Lorenzetti, Franco Mastroddi, Massimo Mecella, Silvia Milana, Giovanni Morabito, Michele Pasquali, Francesco Saltari, Andrei Stancu, Paolo Gaudenzi, Vincenzo Di Pietro</i>	
Structural Health Monitoring as an Enabler for Space 4.0	584
<i>Oleg Testoni, Christoph Karl, Giulio Molinari, Evaristo Odinolfi, Ajay P. Ragupathy</i>	

Scrap Recycling Potential of Prepreg Composites	595
<i>Tasneem Fatima</i>	
Fostering Sustainability of European Launcher Manufacturing Through the Ariane 6 & P120C Process Improvement Programme.....	626
<i>Nicoletta Wagner, Michael Mallon</i>	
Low-Cost Structural Scale Modelling for Space Systems.....	637
<i>Andrew Bowman, Paul Harrison, Philip Ferguson</i>	
Novel Manufacturing Approach for Copper-Alloy Material Used in the Manufacture of Combustion-Facing Thrust Chamber Assembly Components.....	648
<i>Peter Böhlke</i>	
Latest Research on Dynamic Environmental Testing for Space Hardware	652
<i>Alberto G. De Miguel, Umberto Musella, Mattia Dal Borgo, Rúben Araújo, Bart Forrier, Emilio Di Lorenzo</i>	
Laser Micromachining of Composites for Aerospace applications. A review.....	664
<i>Atharva Sawant, Shravani Tembare, Satish Chinchankar</i>	
3D Printed Polymer Structures for Space Applications.....	676
<i>Tomas Valuch, David Šorm, Adam Pinkner</i>	
Additive Manufacturing of Copper Components for the Space Sector: A Technology Comparison.....	684
<i>Marco Grasso, Paolo Parenti, Francesco Galbusera, Talha Sunar, Tanya Scalia, Marco Pizzarelli, Giuseppe D'Amore, Bianca M. Colosimo, Barbara Previtali</i>	

ADVANCEMENTS IN MATERIALS APPLICATIONS, ADDITIVE MANUFACTURING, AND RAPID PROTOTYPING MANUFACTURING AND RAPID PROTOTYPING

Demonstration of Advanced Manufacturing for Launch Vehicles and Engines	692
<i>Yun-Hang Cho, Joshua Glynn</i>	
Laser Powder Bed Fusion for Opto-Mechanical Flight Hardware on Satellites.....	702
<i>Marco Mulser, Thomas Sedlmaier, Alexander Kuisl, Carolin Greve, Eike Volkmann, Stephan Roemer, Hans Thiele, Martin Podehl, Riccardo Benvenuto</i>	
Additive Manufacturing of Space Propulsive Components: Characterization of IN718 Powder Recycling on Final Sample Properties.....	707
<i>Davide Zuin, Simone La Luna, Ludovica Cavallucci, Filippo Maggi</i>	
Practical Investigation into the Diffusion Bonding of 316L Stainless Steel with Boron Carbide for Radiation Shielding in Nuclear Thermal Propulsion Application	722
<i>Calvin Chandler, Timothy Defranco</i>	
ATILIUS - Additive Technologies for Innovative Low-Thrust Iodine Space Unit from Scrap	730
<i>Tommaso Tirelli, Paola De Carlo, Federico Gallizio</i>	
Advancing Sustainable Additive Manufacturing in Space via In-Situ Data Mining: Challenges and Future Prospects	739
<i>Bianca M. Colosimo, Matteo Bugatti, Marco Grasso, Thomas Rohr, Tommaso Ghidini</i>	
Revolutionizing Spacecraft Manufacturing: 3d-Printable Graphene-Pla Composite for Enhanced cubeSat Structures.	745
<i>Basel Altawil, Yarjan A. Samad, Sean S. M. Swei</i>	

Metal 3d Printer Technology Demonstrator; In Orbit Demonstration of Printing 3d Metal Parts	748
<i>Rob Postema, Advenit Makaya, Aidan Cowley, Anthony Lécossais, Patrick Crescence, Gustavo De La Fuente, Sebastien Girault, Nicolas Sprenger, Benjamin Jaillant, Bryan Sepiere, Matthieu Desveaux, Arielle Deprieset</i>	
Gateway Earth ISRU: Manufacturing Mechanical Modules on the Moon.....	758
<i>Matjaz Vidmar, Sam Tammam-Williams, Xiaoming Shi</i>	
Binder Jetting of Lunar Regolith: 3D Printing and Densification	764
<i>Marco Mariani, Francesco Bertolini, Maxim Isachenkov, Carmen Galassi, Nora Lecis, Antonio M. Grande, Giuseppe Sala</i>	

SMART MATERIALS AND ADAPTIVE STRUCTURES & SPECIALIZED TECHNOLOGIES, INCLUDING NANOTECHNOLOGY

Enhancing Lunar Habitat Construction: An Experimental Evaluation of Thermal Performance and Durability of FBG Sensor-Embedded Lunar Bricks.....	772
<i>Carlo G. Ferro, Alessandro Aimasso, Roberto Torre, Andrea E. M. Casini, Aidan Cowley</i>	
Smart Repairable, Recyclable, and Reshapable (3R) Fiber Reinforced Polymers (FRP) with Structural Health Monitoring Capabilities (SHM) Based on a Vitrimeric Matrix Doped with Carbon-Based Nanocomposites.....	779
<i>Javier G. Sánchez, Xoan X. F. Sánchez-Romate, Alberto Jimenez-Suarez, Silvia G. Prolongo</i>	
Simple Shape Finding for Spherical Tensegrity Based on Rotational Location	786
<i>Kanjuro Makihara, Yuta Matsumoto, Daiki Suzuki, Keisuke Otsuka</i>	
Sustainability Assessment of Plasma-Assisted Processes for Thin Film Deposition in Space Applications.....	793
<i>Veronica Orlandi, Gregory Navarro, Myrtil Kahn, Alexis Paillet, Richard Clergereaux</i>	
Polyimide/Graphene Nanocomposites as Antibacterial Coatings for Human Exploration Missions in Space	806
<i>M. Gabriella Santonicola, Francesca Blondelli, Sabina Botti, Francesca Bonfigli, Elisa Toto, Susanna Laurenzi</i>	

VOLUME 2

Application of Smart Sensors and Actuators for Sparse Aperture	815
<i>Brij Agrawal</i>	
Study of the Mechanical Properties of Epoxy Nanocomposite Materials with UCNPs and Graphene and Their Comparison with a Computational RVE/FEM Model.....	819
<i>Jevet E. D. Lopez-Campos, Genoveva Hernández-Padrón, Gonzalo Ramírez-García, M. Concepción Arrocena, José Reinoso-Cuevas, Gerardo Fonseca-Hernández</i>	
Photoelectrochemical Green Hydrogen Production Utilizing ZnO Nanostructured Photoelectrodes	827
<i>Sameerah Al-Saeedi</i>	
Multi Input Single Output Electromechanical Impedance Structural Health Monitoring: Hardware Implementation and Application to Space Vehicles.....	842
<i>Funmilola Nwokocha, David Hunter, Andrei Zagrai</i>	
Predicting and Mitigating Crystallographic Defects in Carbon Nanotubes.....	851
<i>Rati Srivastava, Valentina Senapati, Gurunadh Velidi, Archisha Dhyani</i>	

Reusable Shape Memory Shock Absorption Elements for Space using Additive Manufacturing.....	858
<i>Eleonore Poli</i>	

CATEGORY C "TECHNOLOGY" - EXTRA SESSION

Architectural Design for Attitude Stabilization of a Space Megastructure.....	865
<i>Eloïse Ropert, Hemanth Alapati, Davide Demartini, Julien Leblond, Thibaut Bonduelle, Titouan Offredo</i>	
Assembly and Disassembly Coupled Orbit-Attitude Dynamics of the European Reference Solar Power Satellite.....	875
<i>Maria A. Laino, Massimiliano Vasile</i>	
Spacecraft Shape Optimization Theoretical Guidelines for Fundamental Frequency Regulation.....	886
<i>Giuseppe M. Gagliardi, Francesca Samà, Alessandro Emendato, Anna Mercaldo, Mandar D. Kulkarni, Francesco Marulo</i>	
Multibody Dynamics Analysis Aiming On-Orbit Assembly of 30m-Class Square Lightweight Planer Antenna	899
<i>Mizuki Abe, Daisuke Joudoi</i>	
Guidance Strategies to Deploy a Lunar Satellite Constellation from Gateway	905
<i>Mauro Pontani, Edoardo M. Leonardi, Giulio De Angelis</i>	
NASA Progress on the Development and Qualification of a 12-KW Hall-Effect, Solar Electric Propulsion Thruster	920
<i>Clayton Kachele, George Williams, Rohit Shastry, Aaron Weaver, Bryan Smith, Dean Petters, Timothy Gray</i>	
Next Generation Ultra-Light Weight Flexible Space Solar Cell Design	926
<i>Guler Kocak, Ismail Topcam</i>	
Deep-Space Solid Propulsion System for Orbiting Exploration of Large Gravity Bodies Beyond the Asteroid Belt.....	932
<i>Shinichiro Tokudome, Takanao Saiki, Yuichi Tsuda, Yuki Akizuki, Kenichiro Sawada, Naoki Morishita, Koki Kitagawa, Kohei Matsui, Yuuki Sakamoto, Tetsuya Matsunaga, Keiichi Hori, Satoshi Arakawa, Yoshiki Matsuura</i>	

INTERACTIVE PRESENTATIONS - IAF MATERIALS AND STRUCTURES SYMPOSIUM

Using Pyrotechnic Devices in the Development of Separation Systems for Rocket and Space Technologies.....	941
<i>Anatolii Lohvynenko, Yevhen Boliubash</i>	
Novel Damping Modes using Bio-Inspired Strategies	950
<i>Omid Bateniparvar, M. Shahjahan Hossain, Pranta R. Sarkar, Ranajay Ghosh</i>	
Calculation Method and Experiment Verification of Preload of Clamp Band Device Considering Temperature Influence.....	958
<i>Shipeng Kang, Song Linyu, Wang Liyang, Wang Tianyi, Lan Fuming, Wang Xin</i>	
Evaluating the Feasibility of using a Variable-Length Polymer Suborbital Ultra-Light Launch Vehicle.....	963
<i>Aleksandr Golubek, Mykola Dron, Serhii Aleksieienko, Andrii Dreus, Olena Kositsyna, Vladyslav Proroka, Oleksii Kulyk, Ludmila Dubovik</i>	

CFD Investigation and Optimization on the External Aerodynamics of a Sounding Rocket.....	972
<i>Massimo D. Monica, Matteo Bernardini</i>	
Investigating Carbon Fiber Reinforced Polymer Composites for Enhanced CubeSat Structural Design.....	987
<i>Ashraf Khater, Marwan Almeer, Ahmed Bushlaibi, Ali Alqaraan, Yaqoob Alqassab</i>	
Evaluating Reduced-Order Methods for Hypersonic Vehicle Aerodynamics.....	993
<i>Federica Portis, Domenic D'Ambrosio, Antonio Schettino, Pietro Roncioni</i>	
Static Structural Test and Analysis of Aluminum Skin Stringer Panels at Increased Rivet Spacing	1002
<i>Hae W. Jang, Jae-Seok Yoo</i>	
Thermal and Vibrational Analysis of Peruvian 3U CubeSat CHASQUI II for Low-Earth Orbit Missions	1007
<i>Jhon G. Silvera, Victor M. Q. Soncco, Martin J. R. Levano, Renzo M. R. Nuñez, Raul M. F. Teran</i>	
A Planetary Gear Mechanism for a Competition Rocket Separation System.....	1017
<i>Ricardo Calle, Anibal Esquiembre, Harold Z. Quispe, Luis Solis, Cadney Condor</i>	
In House Design and Analysis of a 6U CubeSat Structural Frame.....	1028
<i>Abdulrahman Sulaiman, Abdalla Elshaal, Antonios Manousakis, Hamid Al Naimiy</i>	
Passive Thermal Control System Design and Temperature Analysis of Thai Space Consortium-1 Satellite.....	1034
<i>Chinphat Patanathabutr</i>	
Analysis of the Structural and Dynamic Behavior of a Model Rocket Tensegrity Fuselage During the Ascent Phase: Influence of Motor Forces on Its Mechanical Response	1043
<i>Abigail González-Alcázar, Bryan M. Medina, Mariana Salazar, Carlos Leon, Andres Gonzalez-Fallas</i>	
Nonlinear Thermo-Elastic Analysis of Laminated Composite Structures for Spacecraft.....	1050
<i>Francesca Bracaglia, Alfonso Pagani, Enrico Zappino, Erasmo Carrera</i>	
Subsystems of a Rover Framed Within the Human Exploration Rover Challenge 2022 Hosted by Nasa.....	1057
<i>Alejandro Riaño, Juan Cifuentes, Juan Bedoya, Sebastián Villa, Miguel Venegas</i>	
Vacuum Arc Coatings from Heat-Resistant Alloys for Combustion Chambers of Liquid-Propellant Rocket Engines.....	1072
<i>Iryna Husarova, Volodymyr Nadtocha, Maksym Kraiev, Dmytro Bondar, Hennadii Osinovi, Andrey Borisenko, Violetta Kraieva</i>	
Using High Speed Vision Measurement Method to Obtain the Dynamic Response of Impact Test Object in Full Field.....	1078
<i>Peng Chen, Qun Zhang, Yi Gao, Hong Lin, Zipeng Yang, Zhongwen Pan</i>	
The Influence of the Vibration Test Facility in the Resonance Frequencies Measured on a Satellite Structure, Introducing Facility Mechanical Impedance in FEA and Facility Characterization.	1083
<i>Andrea Cambiaghi, Abdalla R. S. Ellithy</i>	
The Future Unfolds - Simplifying Polyhedral Space Habitat Module Deployment using a Contiguous Unfolding Method.....	1102
<i>Elliott Ruzicka</i>	

Test and Simulation in High-Enthalpy Atmospheric Re-Entry Conditions of Multi-Phase Ultra-High-Temperature Ceramics.....	1109
<i>Stefano Mungiguerra, Laura Silvestroni, Dylan De Prisco, Raffaele Costanzo, Anselmo Cecere, Raffaele Savino</i>	
Sustainable Extraterrestrial Tool Making using in Situ Resourcing	1118
<i>Achintya Bairat, Guadalupe E. Gastelum</i>	
Study of the Influence of Contact Model Parameters on a Berthing Operation	1124
<i>Davide Sorli, Giulia Calvo, Martina Ferrauto, Francesca Giardina, Mario Troise, Stefano Mauro</i>	
Structural Design, Simulation, and Testing of the BIRDS-X Project's Satellite Dragonfly	1132
<i>Jorge R. C. Ricaño, Tasuku Matsui, Yudai Etsunaga, Guillaume Berson, Hirokazu Masui, Takashi Yamauchi, Mengu Cho</i>	
Stress Analysis on Deployment of CFRP Bistable Boom Under the Environment on the Moon.....	1148
<i>Yuta Sunaga, Sho Kajihara, Tomohiro Yokozeki, Yusuke Sakamoto, Aoi Izumi, Akihito Watanabe</i>	
Spacecraft Materials Analysis in LEO and VLEO Orbits Under Atomic Oxygen Interaction	1152
<i>Salvatore Rea, Michele Guida</i>	
Proposal for the Construction of Lunar Module.....	1159
<i>Gustavo E. A. Gonzalez, Santiago Sandoval, Avril A. González, Itzcoatl N. S. Miguel, Axel N. Arzola</i>	
Polyimide-Based Materials with Self-Healing Properties for Lunar Exploration Missions	1167
<i>M. Gabriella Santonicola, Francesca Blondelli, Guido Saccone, Nunzia Favaloro, Elisa Toto</i>	
Numerical Transient Model for Thermomechanical Fatigue Investigation in Metamaterials	1175
<i>Tommaso Sironi, Maria Cinefra, Andrea Troise</i>	
Numerical Simulation and Analysis of Shoulder Jet Heat Reduction for Mechanical Deployable Reentry Vehicles	1186
<i>Junjie Sun, Hao Zhu, Haizhou Guo, Dajun Xu, Guobiao Cai</i>	
Monitoring of Fin Flutter in a Composite Material Based on Natural Fibers.....	1196
<i>Leonardo B. R. Regino, Odalys R. G. Atzin, María P. P. Gavidia, Ariana R. T. Salas, Atenea M. J. Vázquez, Abril A. V. Sánchez, Isaac E. G. Moran, Yael D. L. Romero, Alexa V. P. Carmona, Higinio J. Ríos</i>	
Modular Androgynous Standard Interface: A Versatile Solution for On-Orbit Servicing	1204
<i>Giuseppe Ventura, Francesco Branz, Andrea Valmorbida, Alessandro Francesconi</i>	
Modal Testing and Dynamic Simulation Verification Techniques for Shock Test.....	1213
<i>Yen T. Liu</i>	
Methods of Protecting Spacecraft and Astronauts from Radiation.....	1217
<i>Melek Baghirova</i>	
Investigation of Thermal Stability of a High-Strength & Corrosion-Resistant Nanocrystalline Aluminum Alloy	1225
<i>Furkan Ozdemir</i>	

Investigation and Parametric Optimization of Laser Surface Texturing for Improved Microparticles Non-Sticking Capacity	1230
<i>Guido Saccone, Nunzia Favalaro, Ambra Vestri, Amalia D'Avino, Lucia Petti</i>	
In-Situ Regolith and Metal Fuel Reactions for Lunar and Martian Additive Manufacturing.....	1240
<i>Connor Macrobbe, Anqi Wang, Jean-Pierre Hickey, John Wen</i>	
High Reliability Critical Strain Theory Based Structural Design Methodology to Achieve a Lightweight Spaceborne Electronics	1251
<i>Kwangwoo Kim, Jeongki Kim, Jaecheol Hwang, Giseong Woo, Jieun Cha, Jiwon Chae, Hyunung Oh</i>	
Geometric Comparison of a Natural Rubber Pad for Vibration Mitigation in the Payload of a Sounding Rocket	1255
<i>Maria P. P. Gavidia, Ariana R. T. Salas, Atenea M. J. Vázquez, Abril A. V. Sánchez, Deni Hernandez, Maria R. L. Esquivel</i>	
Experimental and Numerical Investigation of Mechanical Performance of Martian Regolith Reinforced Polyethylene for In-Situ Manufacturing	1263
<i>Flavia Palmeri, Susanna Laurenzi</i>	
Evaluation of Material Degradation in C/SiC Composite Subjected to Reentry Conditions.....	1271
<i>Marco Riva, Alessandro Airoidi, Matej Borovinšek, Boštjan Vihar, Lorenzo Cavalli, Mario De Stefano Fumo</i>	
Engineering Challenges in Structural Design and Analysis of Lightweight Superconducting Magnets for Space Applications	1277
<i>Dominik Pridöhl, Simon Werner, Hans M. Wagner, Markus Czupalla, Bernd Dachwald, Alexey Dudarev, David Fehr, Laurenz Klein, Matthias Mentink, Tim Mulder, Kai-Uwe Schröder, Arndt S. Von Dratzig, Thorsten Siedenburg, Christian Von Byern, Stefan Schael</i>	
Dynamic Analysis of Finite-Boundary Miura-Ori Structures.....	1290
<i>Seong J. Choi, Yubin Oh, Jinkyu Yang</i>	
Development and Characterization of an Experimental Setup to Study Cold-Welding in Microgravity Conditions	1296
<i>Leonardo Barilaro, Mark Spiteri, Stefano Lopresti, Mark Wylie</i>	
Detailed Thermal Stresses and Free-Edge Effects Analysis of SSPS Antenna Panel	1307
<i>Rebecca Masia, Ryo Higuchi, Enrico Zappino, Alfonso Pagani, Erasmo Carrera, Takahira Aoki, Tomohiro Yokozeki, Xin Lu</i>	
Design of an Adaptive Control Algorithm with Artificial Neural Network for Optimizing the Multi- Blade Airbrake in a High-Power Rocket	1316
<i>Kevin S. C. Rosales, Uwe R. Villanueva, Victor J. A. Lara, Brayam D. Farfan, Guillermo E. D. C. Saavedra, Renato S. G. Olazo, Anibal Esquiembre</i>	
Design and Prototyping of a Smart Propellant Tank for Spacecraft	1326
<i>Ahmed E. S. Nosseir, Angelo Cervone, Chiara Manfletti, Emanuele A. Slejko, Luca Cozzarini, Sven Zaremba, Daniel J. Czech, Youssef Mraidi, Elisabeth Gleis, Yonas S. Muanenda, Maximilian Strobel, Fabrizio Di Pasquale, Claudio J. Oton</i>	
Epoxy-Ceramic as Anticorrosive Aircraft Coating.....	1344
<i>Juan E. C. González, Rogelio V. Camacho, Carmen S. Hernandez, Mercedes S. Hernandez, Juan C. B. Vera, Juan M. M. Miranda</i>	

Design and Development of Primary Structure for a 3u Student Satellite	1350
<i>D. V. R. Surya Vaibhav, Sushir Subramani, D. S. Sreevarun, Shashiraj Somayaji, N. Megha</i>	
Design and Development of a Mechanical Ground Support Equipment for a Radially Opening Origami Structure in Aerospace Applications	1362
<i>Andrea Troise, Giorgia Cifarelli, Tommaso Sironi, Maria Cinefra, Vittorio Netti, Alessandro Buscicchio</i>	
Characterization and Simulation of Advanced Coatings for Space Applications	1371
<i>Riccardo Mantoan, Enrico Zappino, Marco Petrolo, Enrico Lorella, Riccardo Cimino</i>	
Buckling Behavior of CFRP Bistable Open-Section Boom Under Various Fixed Cross-Sections and Load Directions	1379
<i>Shouya Yamashita, Yuta Sunaga, Sho Kajihara, Tomohiro Yokozeki, Yusuke Sakamoto, Aoi Izumi, Akihito Watanabe</i>	
Behavior Analysis of Free Space Capture for Inter-Spacecraft Material Transfer.....	1386
<i>Yuto Nakagawa, Osamu Mori, Takanao Saiki, Yuichi Tsuda</i>	
Assessment of the Manufacturing Feasibility of the Flexible TPS by Filament Winding	1391
<i>Artem Andrianov, Cristian Vendittozzi, Ignazio Dimino, William Silva</i>	
Assembly of Launch Vehicle and Payload Models with Localized Lagrange Multiplier for Coupled Load Analysis.....	1412
<i>Seung C. Lee, Yoon S. Kim, Byung D. Kang, Sung H. Park, Jae-Hung Han</i>	
Ai-Based Predicting Large Deployable Structure Thermal Deformation On-Orbit	1418
<i>Henghui Zhou, Jinbao Chen, Chuanzhi Chen</i>	
Advancing Experimental Rocketry: FDM-Enabled Ceramic Nozzles for Low-Budget Experimental Propellants.....	1424
<i>Diego P. Reyes, Isaac A. P. Morales, Nuria H. Alás</i>	
Additively Manufactured Aerospace Structures Utilizing 3D-Printed Bioplastic Derived from Avocado Waste	1434
<i>Ariana R. T. Salas, María P. P. Gavidia, Abril A. V. Sánchez, Atenea M. J. Vázquez, María R. L. Esquivel, Deni Hernandez</i>	
A Universal Kinematic Modelling Method for Multi-Arms Space Robot with Variable Topology	1439
<i>Hongxu Wang, Jinsheng Guo, Carlo Canali, Chengfei Yue, Xibin Cao, Darwin G. Caldwell</i>	
A Special Insulated Pass-Through for Cryogenics	1445
<i>Andrea Zanin</i>	
Flexural and Interlaminar Shear Strength with EMI Shielding Performance of CF/CNTF Hybrid Composite.....	1450
<i>Mijoung Joung, Kyun-Bae Lee, Tae-Hoon Kim, Yeon-Su Jung, Sangwoo Lim</i>	
Graphene and Graphene-Like Materials for Sensors and Actuators in Aerospace: A Review and Technology Landscape	1456
<i>Tanya Scalia, Marta Albano, Marco Di Clemente, Maria L. Terranova</i>	
Functional Behaviour of Niti Complex Geometries for Innovative Smart Structures Manufactured by Selective Laser Melting.....	1463
<i>Tiziana Biasutti, Paolo Bettini, Antonio M. Grande, Bianca M. Colosimo, Giuseppe Sala, Adelaide Nespoli</i>	

Improved Thermal Dissipation Through Additive Manufactured Composite Conductive Polymer Elements. A Structural and Thermal Model for CubeSat Applications	1469
<i>Franco M. Di Russo, Paolo Marzioli, Michela Boscia, Andrea Delfini, Fabrizio Piergentili, Annamaria Gisario, Massimiliano Barletta</i>	
Investigation of Ultra-Lightweight and Autonomous Deployment Systems for Solar Sails	1491
<i>Julius Karlapp, Martin Tajmar</i>	
Mass-Efficient Temperature Stabilization Device Design for NanoSat System and Its Implementation.....	1498
<i>Kikuko Miyata, Akihiro Takezawa, Masaki Yamagata</i>	
Preliminary Mission Analysis for the 16U4SBSP Mission Concept	1505
<i>Wail Boumchita, Feng Jinglang, Carmine Clemente, Massimiliano Vasile, Caterina Busso, Mehmet S. Uludag, Stefano Speretta, Angelo Cervone, Matteo Madi</i>	
A Deployable and Retractable Inflatable Link for a Space Robotic Manipulator	1517
<i>Pierpaolo Palmieri, Matteo Gaidano, Matteo Melchiorre, Laura Salamina, Davide Sorli, Mario Troise, Stefano Mauro</i>	
Feasibility Evaluation of the Scissor Petal Reflector Concept	1527
<i>Hiroaki Matsubara, Hiroaki Tanaka</i>	
Deployable Origami-Inspired Structures for Future Space Applications: Lessons Learned from Zero-G Flight Experiment and New Developments	1533
<i>Augustin Gallois</i>	
Numerical and Experimental Approach for the Design of CMC and UHTCMC Reusable Structures: Results of AM3aC2A Project	1539
<i>Alessandro Airoidi, Diletta Sciti, Lorenzo Cavalli, Marco Riva, Edoardo Novembre, Antonio M. Caporale, Pietro Galizia, Raffaele Savino, Mario De Stefano Fumo</i>	
Aerospoke: Mission Simulation and Optimal Design	1550
<i>Roberto Carbone, Joel Guerrero, Jan O. Pralits</i>	
SHM of Space Structures: Use of Polarization-Maintaining Fibers to Decouple the Thermo-Mechanical Effect on Fiber Bragg Grating Sensor Measurements.....	1563
<i>Emanuele Casciaro, Tanya Scalia, Marta Albano, Paolo Bettini</i>	
Preliminary Design and Testing of a Non-Mechanical Cover for Space Telescopes: Crystals.....	1578
<i>Mateo Loshi, Marco Peviani, Giacomo Porcarelli, Greta Rosa, Christian Durante, Giacomo Colombatti, Lorenzo Olivieri, Federico Toson</i>	

LATE BREAKING ABSTRACTS (LBA)

Additive Manufacture of Zirconium Alloys for Thermal Propulsion by Selective Powder Deposition	1583
<i>Phylis Makurunje, Jack Callaghan, Simon Middleburgh</i>	
STARFISH: A Soft Bioinspired Robot Actuated by Shape-Memory Alloy Wires for On-Orbit Mapping and Manipulation	1590
<i>Kristina Andreyeva, Mickaël Cupif, David Barnhart</i>	
Exploring the Viability of Cornstarch-Based Bioplastics for Aerospace and Aviation Applications.....	1598
<i>Aitana Tinajero</i>	

Self-Retractable Solar Panel using a Nitinol and Hafnium Structure for Lunar Surface Applications.....	1603
<i>Omar S. Penetro, Arlette P. S. Hernandez, Flavio E. H. López, Jonathan C. López, Laura G. B. Martell, Kátia M. Lombardo, Aurea R. G. Montero, Ivan F. G. Mendoza, Jose L. R. Muñoz, Nadia L. Z. Perez, Gerardo P. Mora, Maximiliano F. Rubio</i>	

Spacecraft Thermal Analysis and Considerations of a Launch Environment.....	1613
<i>Lysanne Page, Robert Zee</i>	

Author Index