

# **Earth and Space 2024**

## **Engineering for Extreme Environments**

Proceedings of the 19th Biennial International Conference on  
Engineering, Science, Construction, and Operations in  
Challenging Environments

Miami, Florida, USA  
15 – 18 April 2024

Volume 1 of 2

### **Editors:**

**Ramesh B. Malla**  
**Justin D. Littell**  
**Sudarshan Krishnan**

**Landolf Rhode-Barbarigos**  
**Nipesh Pradhananga**  
**Seung Jae Lee**

ISBN: 979-8-3313-0879-7

**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 American Society of Civil Engineers  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact American Society of Civil Engineers  
at the address below.

American Society of Civil Engineers  
1801 Alexander Bell Drive  
Reston, VA 20191  
USA

Phone: (800) 548-2723  
Fax: (703) 295-6333

[www.asce.org](http://www.asce.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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# Contents

## *Granular Materials in Space Exploration*

<b>An Experimental Study of the Influence of Particle Size Heterogeneity on Seismic Wave Velocities.....</b>	<b>1</b>
Jules Marti, Santiago Quinteros, T. Dylan Mikesell, Ludovic Margerin, Pierre Delage, and Naomi Murdoch	
<b>Optimizing 3D-Printed Concrete Mixtures for Extraterrestrial Habitats: A Machine Learning Framework.....</b>	<b>14</b>
Pham Duy Hoang, Hyosoo Moon, and Yonghan Ahn	
<b>Casting Lunar Regolith into Durable Materials.....</b>	<b>23</b>
Kyla P. Edison and Kevin Cannon	
<b>Radiation Dissipation Capacity of Lunar Regolith Simulants for Efficient GCR and SPE Protection for Sustained Habitat Formation.....</b>	<b>34</b>
Kaitlin Roberts, Jake Branham, Reza Ashtiani, Meghan Quadrino, and Joel Sloan	
<b>Discrete Element Modeling of LHS-1 Lunar Highlands Simulant and Cone Penetrometer-Regolith Interactions.....</b>	<b>45</b>
Jesus Badal, Qiushi Chen, Liang Zhang, and Lei Wang	
<b>Wear Testing and Modeling of Tools Interacting with Icy Granular Soil.....</b>	<b>56</b>
Zamir Syed, Paul Schafbuch, and Mehari Tekeste	
<b>Electrostatic Sorting of Lunar Regolith Simulants for Sustainable Resource Utilization: Modeling and Characterization of Particle Size Distribution.....</b>	<b>68</b>
Abdullah Al Moinee, Peter Bachle, Kyle Newport, William Schonberg, David Bayless, Jeffrey Smith, Daoru Han, and Fateme Rezaei	
<b>Optimized Development of Lunar Regolith Ceramic Using Sodium Silicate as a Fluxing Agent.....</b>	<b>84</b>
Usman Javed and Faiz Uddin Ahmed Shaikh	
<b>Laser Particle Sizer for Lunar Lander Plumes.....</b>	<b>95</b>
Robert E. Peale, Cameron Kelley, Nagendra Dhakal, Chris J. Fredricksen, Dinidu Hathnagoda, Christian Walker, Philip Metzger, and Adrienne Dove	

<b>RIDER: A World-Class Facility in Planetary Terramechanics Investigations.....</b>	<b>106</b>
Jared M. Long-Fox, Michael P. Lucas, Gabriel E. Blandin, Michael P. Conroy, Joshua D. Conway, Abigail S. Glover, Austin A. Hacker, Clive R. Neal, and Daniel T. Britt	
<b>Densification Kinetics of Synthetic Lunar Regolith Using Optical Dilatometry.....</b>	<b>117</b>
Joseph Wang, Jonathan Lapeyre, and Jeffrey W. Bullard	
<b>LHS-2E and LSP-2: Expanding Exolith Lab’s Lunar Regolith Simulants to Particle Sizes &gt;1 mm.....</b>	<b>127</b>
Parks Easter, Konrad Krol, Isabel Wilburn, Jared Long-Fox, Daniel Britt, and Julie Brisset	
<b>A Hybrid CFD/Engineering Model Tool for Lunar Lander Surface Erosion Prediction.....</b>	<b>137</b>
Andrew Weaver, Thomas Shurtz, Peter Liever, Tim Dawson, Jason Howison, and Jeffrey West	
<b>Gas-Granular Mechanics Observed in a Subscale, Reduced-Pressure Plume–Surface Interaction Test.....</b>	<b>145</b>
Kayla E. Schang	
<i>Exploration and Utilization of Extra-Terrestrial Bodies</i>	
<b>The Development and Characterization of the Shape Memory Alloy Spring Tire for Mars.....</b>	<b>157</b>
Colin Creager, Santo Padula II, Vivake Asnani, Heather Oravec, John Breckenridge, James Benzing, and Paria Naghipour	
<b>ISRU Pilot Excavator Wheel Testing in Lunar Regolith Simulant.....</b>	<b>173</b>
Liz Zhang, Jason Schuler, Adam Dokos, Yinan Xu, Evan Bell, and Thomas Muller	
<b>Reverse-Ephemeris Lunar Navigation for NASA and Commercial Exploration.....</b>	<b>188</b>
Michael S. McBeth and Robert W. Moses	
<b>Mission Concept of Inflatable Tetrahedron Rover for Lava Tube Entry.....</b>	<b>195</b>
Anna Dinkel and Jekan Thangavelautham	
<b>LIBS-Raman Multimodal Architecture for Automated Lunar Prospecting.....</b>	<b>209</b>
Jérôme Pigeon, Foutse Khomh, Richard Boudreault, Ahmed Ashraf, and Pooneh Maghoul	
<b>Development of an In Situ Sample Reception and Pre-Analysis Facility for a Secondary Habitat on the Lunar Surface.....</b>	<b>220</b>
Peter Weiss, Serge Chevrel, Yves Daydou, Makthoum Peer Mohamed, Nisheet Singh, Thibaud Gobert, Thibaut Pouget, and Vladyslav Hayevskyy	

<b>EUROHAB Secondary Habitat: A Potential European Contribution to ARTEMIS.....</b>	<b>231</b>
Peter Weiss, Makthoum Peer Mohamed, Nisheet Singh, Thibaud Gobert, Thibaut Pouget, and Vladyslav Hayevskyy	
<b>Applications of Fundamental Construction Planning for Lunar Bases.....</b>	<b>241</b>
K. Foley and P. Suermann	
<b>Magnetic Separation of Lunar Regolith Simulants with Applications to In Situ Resource Utilization on the Moon.....</b>	<b>251</b>
Peter Bachle, Jeffrey Smith, Fateme Rezaei, David Bayless, William Schonberg, and Daoru Han	
<b>Extraction of Silica and Alumina from Lunar Highland Simulant.....</b>	<b>260</b>
Bertrand Thibodeau, Xavier Walls, and Alex Ellery	
<b>Laboratory Demonstration of Aluminum Metal Extraction from a Lunar Highland Simulant Using Electrochemistry.....</b>	<b>269</b>
Xavier Walls, Alex Ellery, Priti Wanjara, and Katherine Marczenko	
<b>Development of TRIDENT Drill for Ice Mining on the Moon with NASA PRIME-1 and VIPER Missions.....</b>	<b>280</b>
Kris Zacny, Philip Chu, Vince Vendiola, Paul Creekmore, Phil Ng, Sam Goldman, Emily Seto, Kathryn Bywaters, Ezra Bailey, Raymond Zheng, Isabel King, Ash Rashedi, Paul Chow, Robert Huddleston, Gale Paulsen, Alex Wang, Jack Wilson, Jackie Quinn, Amy Eichenbaum, Janine Captain, Julie Kleinhenz, Erin Rezich, Darlene Lim, Zara Mirmalek, David Lees, Rick Elphic, Kimberly Ennico Smith, Tony Colaprete, Valentin Bickel, Kevin Lewis, and TRIDENT, PRIME-1, and VIPER Teams	
<b>TRIDENT Drill Validation Testing in Haughton Crater, Devon Island, Canada.....</b>	<b>294</b>
B. Glass, C. Fortuin, H. Battah, and I. King	
<b>Drilling for Lunar Surface Exploration and Shear Strength Evaluation Based on Drilling Information.....</b>	<b>301</b>
Byung-Hyun Ryu, Janguen Lee, and Hyun-Woo Jin	
<b>Optimization of Bio-Inspired Drill Design Geometry for Lunar Exploration.....</b>	<b>311</b>
Liang Zhang, Lei Wang, Jesus Badal, Quan Sun, and Qiushi Chen	
<b>Unoccupied Aerial System Coring Drill Sampler Development for Applications on Earth and Other Planetary Bodies.....</b>	<b>321</b>
Colin Chen, Kathryn Bywaters, Kris Zacny, Nicklaus Traeden, and Christopher W. Hamilton	
<b>RedWater: Water Mining System for Mars .....</b>	<b>332</b>
Joseph Palmowski, Kris Zacny, Kathryn Bywaters, Bernice Yen, Bolek Mellerowicz, and Jack Schultz	

<b>RocketM: A Propulsive Excavation System for the Moon and Mars.....</b>	<b>343</b>
Jonathan Slavik, Travis Vazansky, and E. Connor Luken	
<b>The Effect of Bending Vibration Modes on Penetration of Bio-Inspired Drilling Tool in Granular Materials: An Experimental Study.....</b>	<b>355</b>
Mahdi Alaei Varnosfaderani, Pooneh Maghoul, and Nan Wu	
<b>Discrete Element Modeling of IPEX Bucket Drum-Lunar Regolith Interactions.....</b>	<b>364</b>
Daniel Gaines, Qiushi Chen, and Laura Redmond	
<b>Moon Trades: Unlocking the Potential of Lunar Mining and Resource Utilization.....</b>	<b>373</b>
Eronim Mihoc, Wintta K. Ghebreyesus, Madison C. Feehan, and Fabio Giuseppe Bisciotti	
<b>EURO2MOON: Leveraging Lunar Resources Exploration to Foster International Collaboration and Benefit Sustainability in Space and Earth.....</b>	<b>383</b>
Pierre-Alexis Joumel, Pascal Barbier, and Carlos Espejel	
<i>Advanced Materials and Designs for Aerospace and Terrestrial Structures under Extreme Environments</i>	
<b>In-Plane Elasto-Plastic Characterization of 3K70PW Carbon Fabric/INF14 for MAT 213 Material Model.....</b>	<b>388</b>
Suresh Keshavanarayana, Shritha Jagadheeswaran, and Ganesh Yerram	
<b>A Rational Approach to Building Cohesive Zone Model for Use in Modeling Impact Analysis.....</b>	<b>401</b>
Mohammed Raihan, Ashutosh Maurya, and Subramaniam Rajan	
<b>Calculation of Stress Intensity Factors for a Multiple Crack–Hole Interaction Problem.....</b>	<b>416</b>
Asif I. Khawaja and Wieslaw K. Binienda	
<b>Multi-Scale Experimental Characterization for LS-DYNA MAT213 Modeling of Composite Structures under High Strain Rate.....</b>	<b>430</b>
Jacob Black, Ryan Premo, Robert K. Goldberg, Trenton M. Ricks, Troy Lyons, and Han-Gyu Kim	
<b>On a Nonlinear, Locally Resonant Metamaterial with Topological Features.....</b>	<b>440</b>
Arun Malla, Joshua LeGrande, Mohammad Bukhari, and Oumar Barry	
<b>On the Development of Sulfur-Regolith Concrete as an ISRU-Based Construction Material for Lunar and Martian Infrastructure.....</b>	<b>452</b>
Ilerioluwa Giwa, Mary Dempsey, Joseph Lamendola, Ali Kazemian, and Michael Fiske	

<b>Structural Analysis of Sandbag Topology for Lunar Environment Utilization.....</b>	<b>463</b>
Yinan Xu, Sivaperuman Muniyasamy, Carlos Doe, and Jekan Thangavelautham	
<b>Investigating the Effect of Air Voids on the Mechanical Properties of 3D Printable Cementitious Composites.....</b>	<b>474</b>
Reese Sorgenfrei, Peyman Zandifaez, Hongyu Zhou, and Michael Fiske	
<b>Analysis of a Landing System for Planetary Payloads Utilizing Passive Energy Absorbing Composite Structure.....</b>	<b>483</b>
Matlock M. Mennu, Jacob B. Putnam, and Justin D. Littell	
<b>Trade Study of Impacting Resisting Structures on the Lunar Surface.....</b>	<b>494</b>
Arsalan Majlesi, Amir Behjat, Adnan Shahriar, David Avila, Shirley J. Dyke, Julio Ramirez, and Arturo Montoya	
<b>Behavior of Stuffed Whipple Shields Subjected to Micrometeoroid and Orbital Debris Impact.....</b>	<b>509</b>
Md. Abdur Rakib, Scott T. Smith, and T. Tafsirojjaman	
<i>Structures in Challenging Environments: Dynamics, Controls, Smart Structures, Health Monitoring, and Sensors</i>	
<b>Quantifying the Impact of Sensor Degradation on Structural Damage Detection in Deep Space Habitats.....</b>	<b>517</b>
Zixin Wang, Manuel Salmerón, Herta Montoya, Mohammad R. Jahanshahi, and Shirley J. Dyke	
<b>Physics Informed Neural Networks for Inverse Estimation in the Presence of Sparse Data.....</b>	<b>528</b>
Anthony LoRe Starleaf, Siddharth Parida, Souvik Chakraborty, Georgios Apostolakis, and Nidhish Jain	
<b>An Innovative Baseline-Free Approach to Bolted Flange Looseness Detection Using Percussion and Spectral Clustering.....</b>	<b>538</b>
Jian Chen and Gangbing Song	
<b>Origami Infrastructure: A Viable Solution to Construction for Challenging Environments.....</b>	<b>549</b>
Claudia Calle Müller, Alvaro Ballón Bordo, and Mohamed Elzomor	
<b>Aerostructural UAV Main Rotor Optimisation Algorithm Considering Mass and Strength Limitations.....</b>	<b>559</b>
J. Kocjan, S. Kachel, and R. Rogólski	

**Structural Phase Transformation in a Simplex Tensegrity.....567**  
 Ranganathan Parthasarathy, Srinivasan Sivakumar, Anil Misra, Hriday Roy,  
 Paul Resch, Kehinde Omotayo, Andrew Mikhaeil, Mohammad Amin Hodaei,  
 Lin Li, Catherine Armwood-Gordon, Roger Painter, Youngjae Choi, and Deo Chimba

**Sensor Fault Detection Approach to Tensegrity Structures Using  
 Markov Parameters.....584**  
 Yuling Shen, Muhao Chen, Ed Habtour, and Robert E. Skelton

*Space Engineering, Construction, and Architecture for the Moon, Mars, and Beyond*

**Design, Analysis, and Implementation of Modular Blocks for Lunar Habitable  
 Infrastructure.....594**  
 Nerma Caluk and Atorod Azizinamini

**Engineering Design of Lunar Structure Regolith Shielding to Resist  
 Hypervelocity Meteoroid Impacts.....609**  
 Sushrut Vaidya and Ramesh B. Malla

**Seismic Vulnerability Assessment of Non-Structural Elements Inside  
 an Inflatable Lunar Habitat.....625**  
 Oscar D. Forero, Julio A. Ramirez, and Shirley J. Dyke

**D.N.A.—Designing New Abodes on the Moon: Pioneering the First Permanent  
 Lunar Station.....637**  
 Marta Rossi, Federica Joe Gardella, Mariapia Mammìno, Elif Kirmiziyesil,  
 Ebru Nur Yavuz, and Valentina Sumini

**Contribution of Recent Lunar Missions to Understanding of Lunar  
 Environment—An Update.....646**  
 Alexander M. Jablonski and Kin F. Man

**Lunar Lava Tubes for Segmented Base Architecture on the Moon.....663**  
 Claire L. Pedersen, Aleksandar Antonic, Farah M. Alqaraghuli, Riley E. Mayes,  
 and Jekan Thangavelautham

**Stresses and Deflection of a Lunar Habitat under Extreme Daily Temperature  
 with and without Regolith Cover.....676**  
 Sachin Tripathi and Ramesh B. Malla

**Effects of Extreme Daily Temperature on Tall Truss-Type Solar Power Structure  
 on the Moon.....690**  
 Hernan Cortez Jr. and Ramesh B. Malla



<b>Kresling Origami-Inspired Structures: Exploring Structure Types, Applications, Properties, and Analysis Methods.....</b>	<b>704</b>
Hadi Ebrahimi Fakhari, Mojtaba Moshtagzadeh, and Pezhman Mardanpour	
<b>Fatigue Life Optimization and Design of a Reconfigurable Cylindrical Origami-Inspired Structure with Miura-Ori Pattern.....</b>	<b>716</b>
Hadi Ebrahimi Fakhari, Mojtaba Moshtagzadeh, and Pezhman Mardanpour	
<b>Control Towers as Multifunctional Structures for Lunar Surface Activity.....</b>	<b>728</b>
Sivaperuman Muniyasamy, Athip Thirupathi Raj, Min Seok Kang, Nicolas Gross, Camden Nelson, Michael Villasana, Korbin Hansen, Aidan Cler, and Jekan Thangavelautham	
<b>An Ontology to Represent and Combine Multi-Disciplinary Design Knowledge for Lunar Habitat Design, Deployment, and Maintenance.....</b>	<b>744</b>
Arne Martensen and Timo Hartmann	
<b>Preliminary Analysis of Regolith–Foundation–Structure Interactions .....</b>	<b>752</b>
T. Adach, T. D. Mikesell, S. W. Ximenes, M. Fateri, and A. Cowley	
<b>Compaction Testing on Lunar Highland Simulant Using a Vibrating Drum Roller .....</b>	<b>763</b>
Akshay K. Agarwal, Mark B. Jakska, Brendan T. Scott, and Yien Lik Kuo	
<b>Crushing Potential of Lunar Regolith Simulants: Implications for Strength Degradation.....</b>	<b>774</b>
Jesus Baca and Reza S. Ashtiani	
<b>Bearing Capacity Estimation in Nonlinear Granular Deposits under Reduced Gravity Field: Lunar Applications.....</b>	<b>785</b>
Reza Jamshidi Chenari and Pooneh Maghoul	
<b>Moonfiber: Design of a Lunar Lavatube Outpost Using Regolith-Composite Fibers.....</b>	<b>794</b>
Vittorio Netti, Paolo Mangili, Alessandro Angione, Ivana Fuscello, and Isabella Paradiso	
<b>Importance of Psychological Factors for Extraterrestrial Base and Site Planning.....</b>	<b>808</b>
Olga Bannova, Sheryl Bishop, James A. Wise, and Sandra Häuplik-Meusburger	
<b>Exploring Multi-Directional 3D Printing for Enclosures on Earth and Beyond: Sensitivity Analysis of Buildability.....</b>	<b>821</b>
Nusrat Tabassum and José Pinto Duarte	
<b>Towards Resilient Lunar Architecture: A Systematic Literature Review of Earth-Based Repair Frameworks for Use in Lunar Construction.....</b>	<b>833</b>
Monika E. B. Stankiewicz, Amit Srivastava, and Scott T. Smith	

<b>Application of Regolith Polymer Composite Fused Granular Fabrication Construction in Simulated Lunar Conditions.....</b>	<b>844</b>
Nathan J. Gelino, Evan A. Bell, David I. Malott, Steven E. Pfund, Matt W. Nugent, and Marco A. Gudino	
<b>Topological Interlocking Bricks for Habitat Construction in Extraterrestrial Environments.....</b>	<b>858</b>
Maëlle Mathieu, Parisa Haji Abdulrazagh, Alexander M. Jablonski, and Pooneh Maghoul	
<b>Quality Assurance for Construction on the Moon, Mars, and Beyond.....</b>	<b>868</b>
Ramiro A. Besada	
<b>Exploring the Ethical Dimensions of Space Construction: A Holistic Examination of Resource Extraction, Social Sustainability, and Global Equity.....</b>	<b>877</b>
Erika Rivera and Mohamed Elzomor	
<b>Micromechanical and Microstructural Analysis of Lunar Concrete.....</b>	<b>884</b>
M. Sulaiman Dawood, Peter J. Collins, Aleksandra Radlińska, and Robert J. Thomas	
<b>A Comprehensive Analysis of Autonomous Construction of a Lunar Landing Pad Using a Network of Small Robots.....</b>	<b>896</b>
Sivaperuman Muniyasamy, Aidan O’Neill Cler, and Jekan Thangavelautham	
<b>Lunar Landing and Launch Pad Construction Using Concentrated Solar Energy to Fuse Lunar Regolith Feedstock.....</b>	<b>912</b>
Alan Carter, Andrew Brewer, and Ryan Garvey	
<b>Site Preparation for a Lunar Launch and Landing Pad.....</b>	<b>924</b>
Samuel W. Ximenes, Barney Gorin, Ronald Wells, James Johnson, Reynaldo Trevino, Donald Hooper, Sazzad Shafique, Ibukun Awolusi, Chinedu Okonkwo, Mark Jaksa, Gary Bastin, Oskar Fryckowski, Marek Wigucki, Damian Pietrusiak, Codie Petersen, Joshua Torgerson, Jaret Matthews, and Lutz Richter	
<b>Mobile Launcher Refresh for the Kennedy Space Center .....</b>	<b>941</b>
Kevin MacLeod, Luis Moreschi, and Peter Carrato	
<b>On the Incorporation of Both Function-Driven Requirements and Topology Optimization in the Development of Lunar Launch and Landing Pads.....</b>	<b>952</b>
Luke L. Scharber and Michael R. Fiske	
<b>A New Launch Pad Failure Mode: Analysis of Fine Particles from the Launch of the First Starship Orbital Test Flight.....</b>	<b>964</b>
Brandon Dotson, Phil Metzger, Jason Hafner, Autumn Shackelford, Kyra Birkenfeld, Dan Britt, Anastasia Ford, Rhys Truscott, Shanna Truscott, Jill Zavaleta, Joseph Zemke, Kenneth Purvis, Murray Scudder, Christopher Johnson, John Galloway, and Jay DeShetler	

<b>Additive Manufacturing of Polyether Ether Ketone (PEEK)/Lunar Regolith Composites via Fused Filament Fabrication.....</b>	<b>976</b>
Mohammad Azami, Pierre-Lucas Aubin Fournier, and Krzysztof Skonieczny	
<b>Spark Plasma Sintering of NUW-LHT-5M Lunar Highland Simulant: Effect of Sintering Temperature on Physical, Mechanical, and Microstructural Properties.....</b>	<b>987</b>
In Kyu Jeon and Yong-Rak Kim	
<b>Mechanical Properties of Regolith-Resin-Based Composite (RRC) for Lunar Construction Utilizing In Situ Resources.....</b>	<b>995</b>
Mohammad Altaf Hossain, Scott T. Smith, and T. Tafsirojjaman	
<b>Thermal and Structural Analysis of Autonomously In-Space and Lunar Assembled Truss Modules.....</b>	<b>1006</b>
Nicolas Gross, Athip Thirupathi Raj, and Jekan Thangavelautham	
<b>Are 3D Printers Universal Constructors?.....</b>	<b>1025</b>
Alex Ellery	
<b>Identification and Economic Analysis of Practical Additively Manufactured Parts for Use on the Lunar Surface.....</b>	<b>1040</b>
David Purcell and Christopher B. Dreyer	
<b>Strengthening and 3D Printing of Magnesium Silicate Hydrate (MSH) Binder for Martian Construction.....</b>	<b>1052</b>
Shayan Gholami, Yong-Rak Kim, and Faezeh Salehi	
<b>RENEST: Low Energy Additive Construction for the Moon and Mars.....</b>	<b>1061</b>
Travis Vazansky, Jonathan Slavik, E. Connor Luken, and Christian Andersen	
<b>Understanding the Effects of Moonquakes on Lunar Infrastructure Based on the Data Obtained from ALSEP.....</b>	<b>1072</b>
Nerma Caluk and Dean Whitman	
<b>Trials and Tribulations of Asteroid Mining.....</b>	<b>1085</b>
Alex Ellery	
<b>Decommissioned Fighters as Airborne Launch Platforms for Space Operations.....</b>	<b>1099</b>
Aleksander Olejnik, Stanisław Kachel, Piotr Zalewski, Łukasz Kiskowskiak, Robert Rogólski, and Michał Frant	
<b>Modeling Deformable Linear Objects for Autonomous Robotic Outfitting of Lunar Surface Systems.....</b>	<b>1112</b>
Amy M. Quartaro, John R. Cooper, Joshua N. Moser, and Erik E. Komendera	
<b>Robotics for Systems Integration in Buildings: Pilot Study of Viable Approaches to Install Hygrothermal and Rigid Electrical Systems.....</b>	<b>1125</b>
Naveen Kumar Muthumanickam, Luke Boyd, and Shanti Pless	