



**ASME 2013 INTERNATIONAL DESIGN ENGINEERING TECHNICAL CONFERENCES  
and COMPUTERS AND INFORMATION IN ENGINEERING CONFERENCE**

**AUGUST 4-7, 2013 • PORTLAND, OREGON**

# **Symposium on Origami-Based Engineering Design**

**As part of the 37<sup>th</sup> ASME Mechanisms & Robotics Conference  
At the ASME 2013 International Design Engineering Technical Conferences  
August 6-7, 2013, Portland, Oregon, USA**

Origami shows great promise for providing insight and inspiration for future discoveries and new applications. The Symposium on Origami-Based Engineering Design has been created to provide a venue for researchers to present their work, interact with other researchers in the field, and discuss future trends and needs. The symposium consists of technical presentations by authors of accepted papers, a plenary address, and opportunities for informal discussions and networking.

## **SYMPOSIUM ORGANIZERS**

Larry L. Howell  
Brigham Young University  
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## **LOCATION**

All sessions will be held at the Oregon Convention Center, 777 NE MLK, Jr. Blvd., Portland, Oregon. Specific rooms for the sessions will be printed in the conference program available at registration.

## **SYMPOSIUM SCHEDULE**

The symposium is organized into six sessions. The first session includes the plenary address followed by two technical papers. The other sessions include technical presentations organized into sessions with similar topics. There is also time between session and in evenings for informal discussions between symposium attendees.

### **MR-11-1 Actuation for Origami Structures**

Tuesday, August 6, 2013 8:30 AM - 10:10 AM

*Session Chair:* Larry Howell, Brigham Young University

*Session Co-Chair:* Timothy Simpson, Penn State University

Symposium Plenary Address

**“From Flapping Birds to Space Telescopes: The Math and Magic of Origami”**

**Robert Lang**  
*Lang Origami*

DETC2013-12405: Multi-Field Responsive Origami Structures: Preliminary Modeling and Experiments

By: Saad Ahmed, *Pennsylvania State University*, Carlye Lauff, *Pennsylvania State University*, Adrienne Crivaro, *Pennsylvania State University*, Kevin McGough, *Pennsylvania State University*, Robert Sheridan, *Rowan University*, Mary Frecker, *Pennsylvania State University*, Paris Von Lockette, *Rowan University*,

Zoubeida Ounaies, *Pennsylvania State University*, Timothy Simpson, *Pennsylvania State University*, Jyh-Ming Lien, *George Mason University*, Rebecca Strzelec, *Pennsylvania State University*

**DETC2013-13439: Simulation-Based Design of a Self-Folding Smart Material System**

By: Edwin Peraza-Hernandez, *Texas A&M University*, Darren Hartl, *Texas A&M University*, Richard Malak, *Texas A&M University*

**DED Luncheon**

Tuesday, August 6, 2013 12:15 PM – 1:45 PM

**MR-11-2 Origami as Mechanisms**

Tuesday, August 6, 2013 1:45 PM – 3:25 PM

*Session Chair:* Jian Dai, *Kings College-Univ of London*

*Session Co-Chair:* Gregory Chirikjian, *Johns Hopkins University*

**DETC2013-12227: Classification of Origami-Enabled Foldable Linkages and Emerging Applications**

By: Ketao Zhang, *King's College of London*, Jian Dai, *King's College-Univ of London*

**DETC2013-12584: Four Motion Branches of an Origami Based Eight Bar Spatial Mechanism**

By: Yun Qin, *King's College of London*, Jian Dai, *King's College-Univ of London*

**DETC2013-13407: An Approach for Understanding Action Origami as Kinematic Mechanisms**

By: Landen Bowen, *Brigham Young University*, Clayton Grames, *Brigham Young University*, Spencer Magleby, *Brigham Young University*, Robert Lang, *Lang Origami*, Larry Howell, *Brigham Young University*

**DETC2013-12753: Origami Rotors: Imparting Continuous Rotation to a Moving Platform Using Compliant Flexure Hinges**

By: Matthew Moses, *Independent Consultant*, M. Kendal Ackerman, *Johns Hopkins University*, Gregory Chirikjian, *Johns Hopkins University*

**DETC2013-12947: The Rigid Origami Patterns for Flat Surface**

By: Yan Chen, *Tianjin University*, Sicong Liu, *Nanyang Technological University*, Guoxin Lu, *Nanyang Technological University*

**MR-11-3 Origami Inspired Deployable Systems**

Tuesday, August 6, 2013 3:45 PM – 5:25 PM

*Session Chair:* Mary I. Frecker, *The Pennsylvania State University*

*Session Co-Chair:* Robert Lang, *Lang Origami*

**DETC2013-12348: Accommodating Thickness in Origami-Based Deployable Arrays**

By: Shannon Zirbel, *Brigham Young University*, Robert Lang, *Lang Origami*, Spencer Magleby, *Brigham Young University*, Mark Thomson, *NASA Jet Propulsion Laboratory*, Deborah Sigel, *NASA Jet Propulsion Laboratory*, Phillip Walkemeyer, *NASA Jet Propulsion Laboratory*, Brian Trease, *NASA Jet Propulsion Laboratory*, Larry Howell, *Brigham Young University*

**DETC2013-12725: Application of Conformal Maps to Origami-Based Structures: New Method to Design Deployable Circular Membranes**

By: Sachiko Ishida, *Meiji University*, Taketoshi Nojima, *Art Excel Co., Ltd.*, Ichiro Hagiwara, *Meiji University*

**DETC2013-12901: New Deployable Structures Based on Elastic Origami Model**

By: Kazuya Saito, *The University of Tokyo*, Akira Tsukahara, *The University of Tokyo*, Yoji Okabe, *The University of Tokyo*

**DETC2013-13378: Advanced Folding Approaches for Deployable Spacecraft Payloads**

By: Whitney Reynolds, *Air Force Research Laboratory, Space Vehicles*, Sungeun Jeon, *Moog/CSA Engineering*, Jeremy Banik, *Air Force Research Laboratory, Space Vehicles*, Thomas Murphey, Ph.D., *DR-III, Air Force Research Laboratory*

**DETC2013-13490: Conceptual Model Study Using Origami for Membrane Space Structures**

By: M.C. Natori, *Waseda University*, Nobuhisa Ktsumata, *Waseda University*, Hiroshi Yamakawa, *Waseda University*, Hiraku Sakamoto, *Tokyo Institute of Technology*, Naoko Kishimoto, *Setsunan University*

**MR-11-4 Origami Methods in Non-Paper Materials**

Wednesday, August 7, 2013 8:30 AM – 10:10 AM

*Session Chair:* Spencer Magleby, *Brigham Young University*

*Session Co-Chair:* Zhong You, *Oxford University*

**DETC2013-12497: PCB Origami: A Material-Based Design Approach to Computer-Added Foldable Electronic Devices**

By: Yoav Sterman, *MIT*, Erik D. Demaine, *MIT*, Neri Oxman, *MIT*

**DETC2013-12343: Kinematic and Stiffness Analysis of an Origami-Type Carton**

By: Chen Qiu, *King's College London*, Vahid Aminzadeh, *King's College London*, Jian Dai, *King's College-University of London*

**DETC2013-12226: Novel Design Concept of Planar Litz Winding Without Via Using Folded Printed Circuit Board**

By: Tsuyoshi Nomura, *Toyota Research Institute of North America*, Kayoko Seto, *Toyota Motor Corporations*, Ken Toshiyuki, *Toyota Motor Corporations*

**DETC2013-12681: Quasi-Static Impact Response of Alternative Origami-Core Sandwich Panels**

By: Joseph Gattas, *Oxford University*, Zhong You, *Oxford University*

**DETC2013-13495: A Novel Origami Crash Box with Varying Profiles**

By: Jiayao Ma, *University of Oxford*, Zhong You, *Oxford University*

**MR-11-5 Origami-Based Methods**

Wednesday, August 7, 2013 1:30 PM – 3:10 PM

*Session Chair:* Brian Trease, *NASA Jet Propulsion Laboratory*

*Session Co-Chair:* Richard Malak, *Texas A&M University*

**DETC2013-13231: Designing Origami Structures through Computational Evolutionary Embryogeny**

By: Wei Li, *Texas A&M University*, Daniel McAdams, *Texas A&M University*

DETC2013-12692: Joining Unfoldings of 3-D Surfaces

By: Cynthia Sung, *MIT*, Erik D. Demaine, *MIT*, Martin L. Demaine, *MIT CSAIL*, Daniela Rus, *MIT*

DETC2013-13553: Folding Mechanics of Natural and Synthetic Construction Papers

By: Abhinav Rao, *University of Michigan*, Sameh Tawfick, *University of Michigan*, Matthew Shlian, *University of Michigan*, A. John Hart, *University of Michigan*

DETC2013-13477: Digital Origami from Geometrically Frustrated Tiles

By: C. K. Harnett, *University of Louisville*, C. J. Kimmer, *Indiana University Southeast*

DETC2013-13016: The Deformable Wheel Robot Using Magic-Ball Origami Structure

By: Dae-Young Lee, *Seoul National University*, Ji-Suk Kim, *Seoul National University*, Sa-Reum Kim, *Seoul National University*, Je-Sung Koh, *Seoul National University*, Kyu-Jin Cho, *Seoul National University*

**MR-11-6 Tessellations**

Wednesday, August 7, 2013 3:30 PM – 5:10 PM

*Session Chair:* Alexander Slocum, *MIT*

*Session Co-Chair:* Tomohiro Tachi, *The University of Tokyo*

DETC2013-12326: Freeform Origami Tessellations by Generalizing Resch's Patterns

By: Tomohiro Tachi, *The University of Tokyo*

DETC2013-12659: Realtime Rigid Folding Algorithm for Quadrilateral-Based 1-DOF Tessellations

By: Yves Klett, *Institut für Flugzeugbau, Universität Stuttgart*

DETC2013-12710: Reconstructing David Huffman's Origami Tessellations

By: Eli Davis, *MIT CSAIL*, Erik D. Demaine, *MIT*, Martin L. Demaine, *MIT CSAIL*, Jennifer Ramseyer, *MIT CSAIL*

DETC2013-12743: Manufacture of Arbitrary Cross-Section Composite Honeycomb Cores Based on Origami Techniques

By: Kazuya Saito, *The University of Tokyo*, Sergio Pellegrino, *California Institute of Technology*, Taketoshi Nojima, *Art Excel Co., Ltd.*

DETC2013-13324: Performance of Foldcores – Mechanical Properties and Testing

By: Marc Grzeschik, *University of Stuttgart Institute of Aircraft Design*