Shuodao Wang

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School of Mechanical & Aerospace Engineering
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Academic Appointment

Aug 2014 –present Assistant Professor, School of Mechanical & Aerospace Engineering
Oklahoma State University

Apr 2012 –Aug 2014 Post Doctoral Research Associate, University of Illinois at Urbana-Champaign
Advisor: Prof. John A. Rogers

Education

Mar 2012 Ph.D. in Mechanical Engineering, Northwestern University, Evanston, IL
Advisor: Prof. Yonggang Huang

Jul 2007 B.S. in Engineering Mechanics, Tsinghua University, Beijing, China

Research Interests

- Dynamic Mechanical behaviors and material properties of soft biological tissues
- 3D Stereoimaging for full-field displacement measurements
- Mechanical behaviors of soft and thin web materials
- Experimental and theoretical micro/nano solid mechanics and their applications in micro-electronics, and soft robotics
- Inverse finite element simulations for material property identifications.

Research Experience

- **Wrinkling of tympanic membrane under mismatched pressure**
- **Stability of nonwoven webs due to thickness/density variations**
- **Mechanics of Stretchable and Curvilinear Electronics**
  - Analytical model that predicts buckling of thin film on elastomeric substrate
  - Analytical toolkit for design and fabrication of Curvilinear Electronics
  - Mechanics models for the mounting of ultra-thin Epidermal Electronics (e.g. temperature and electro-physiological sensors) onto the skin

- **Mechanics of Transfer Printing**
  - Modeling and design of an inflatable, programmable transfer printing protocol that enables heterogeneous integrations of electronic components and elastomeric materials
- **Design and Fabrication of Thermal-mechanical Responsive Smart Devices**
  - Experimental measurements on elastic limit of micro-electronics
  - Fabrication and design of deformable, programmable micro-optical device
  - Fabrication and testing on flexible artificial camouflage skin that senses the ambient optics and changes color accordingly

Teaching and Mentoring Experience

Jan 2018 Graduate course taught: **MAE5533 Theory of Elasticity**

Jan 2017 Graduate course taught: **MAE5503 Mechanics of Advanced Composites**

Jan 2015 Graduate course taught: **MAE 5603 Stability of Structures**

2014–2019 Undergraduate course taught: **MAE 3323 Mechancial Design I**

2015–2019 **Mentored underrepresentative undergraduates via OK-LSAMP**, mentored minority undergraduate students

2012–2013 **Mentored undergraduates in micro-fabrication**, mentored Master, Ph.D. students and visiting scholars in mechanics modeling

Feb 2011 **MIT Course Development**, My paper *Soft Matter 2010* was used as course material in *"Mechanics and Materials"* taught by Prof. Pedro M. Reis

Jul 2010 **Public Teaching**, *"NanoDay"*, the Museum of Science and Industry (Chicago), nanotechnology demonstration events for the general audience

Jul 2010 **Teaching Fellow**, *"NUSplash!"*, Northwestern University teaching events for high school students in the Chicago area

2009–2010 **Teaching Assistant**, *Engineering Analysis 2&3*, Northwestern University, gave review lectures and held office hours for over 80 undergraduates

Honors and Awards

2019 NSF Faculty Early Career Development Program (CAREER) award

2015 ASME Applied Mechanics Division - Haythornthwaite Foundation Research Initiation Grant (one of the 4 recipients in 2015)

2011 Terminal Year Fellowship, Northwestern University

2011 Haythornthwaite Foundation Travel Award from ASME Applied Mechanics Division

2011 ASME Applied Mechanics Division Best Student Paper Competition, Third Place

2011 International Institute for Nanotechnology (Northwestern University) Outstanding Graduate Student

2010 Chinese Government Award for Outstanding Self-financed Students Studying Abroad

2009–2012 Ryan Fellowship for Nano Science/Technology, International Institute for Nanotechnology, Northwestern University

Publications

Journal Articles Published at Rank (Since August 2014)

[20] Y. Chen, H. Wang, Y. Zhang[1], R. Li, C. Chen, H. Zhang, S. Tang, S. Liu, X. Chen, H. Wu, R. Lv, X. Sheng, P. Zhang*, **S. Wang***[2], L. Yin*, "Electrochemically-triggered degradation of silicon membranes for smart on-demand transient electronic devices", *Nanotechnology* (accepted 2019)

[19] X. Han, K. J. Seo, Y. Qiang, Z. Li, S. Vinnikova, Y. Zhong, P. Hao, **S. Wang***, and H. Fang*, "Nanomeshed Si Nanomembranes", *npj Flexible Electronics* **3:** Article 9, **DOI**|10.1038/s41528-019-0053-5 (2019)

[18] S. Bao, **S. Wang***, "A unified procedure for free transverse vibration of rectangular and annular sectorial plates", Arch. Appl. Mech., **DOI**|10.1007/s00419-019-01519-y (2019)

[17] S Bao*, J. Cao, and **S. Wang**, "Vibration Analysis of Nanorods by the Rayleigh-Ritz Method and Truncated Fourier Series", *Results in Physics*, **12**, 327–334 (2018)

[16] X. Meng*, Z. Wang, S. Vinnikova, and **S. Wang**, "Mechanics of Periodic Film Cracking in Bilayer Structures under Stretching", *Journal of Applied Mechanics*, **85:**7, 071006 (2018)

[15] X. Meng*, B. Liu, and **S. Wang**,"Third-order polynomials model for analyzing stickup state laminated structure in flexible electronics", *Acta Mechanica Sinica*, **34:**1, 48-61 (2018)

[14] B. Wang, S. Bao, S. Vinnikova, P. Ghanta, and **S. Wang**,"Buckling analysis in stretchable electronics", *npj Flexible Electronics***1:**5, 170484 (2017)

[13] S. Bao* and **S. Wang**, "A generalized solution procedure for in-plane free vibration of rectangular plates and annular sectorial plates", *R Soc Open Sci.* **4:**8, 170484 (2017)

[12] S. Bao*, **S. Wang**, and B. Wang, "An Improved Fourier–Ritz Method for Analyzing In-Plane Free Vibration of Sectorial Plates", *Journal of Applied Mechanics* **84**, 091001-1 (2017)

[11] B. Wang, P. Ghanta, S. Vinnikova, S. Bao, J. Liang, H. Lu, and **S. Wang***, "Wrinkling of Tympanic Membrane under Unbalanced Pressure," *Journal of Applied Mechanics* **84:**4, 041002 (2017)

[1]Mentored students underlined.
[2]Corresponding author.

[10] X. Meng*, G. Liu, Z. Wang, **S. Wang***, "Analytical Study of Wrinkling in Thin-Film-on-Elastomer System with Finite Substrate Thickness," *Applied Mathematics and Mechanics* **4:**38, 469-478 (2017)

[9] Y. Su, X. Ping, K. J. Yu, J. W. Lee, J. A. Fan, B. Wang, M. Li, R. Li, D. V. Harburg, Y.A. Huang, C. Yu, S. Mao, J. Shim, Q. Yang, P.-Y. Lee, A. Armonas, K.-J. Choi, Y. Yang, U. Paik, T. Chang, T. J. Dawidczyk, Y. Huang, **S. Wang***, and J. A. Rogers*, "In-Plane Deformation Mechanics for Highly Stretchable Electronics", *Advanced Materials* **29:**8 1604989 (2016)

[8] S. Han†[3], M. Kim†, B. Wang, D. Wei, **S. Wang***, C. H. Lee*, "Networked nanocomposite elastomers for mechanically reinforced skin electronics", *Advanced Materials* **38:**46, 10257-10265 (2016).

[7] B. Wang and **S. Wang***, "Adhesion-Governed Buckling of Thin-Film Electronics on Soft Tissues," *Theor. Appl. Mech. Lett.*, **6:**1, 6-10 | **DOI:**10.1016/j.taml.2015.11.010 (2016)

[6] **S. Wang***, Y. Huang and J. A. Rogers*, "Mechanical Designs for Inorganic Stretchable Circuits in Soft Electronics," *IEEE Trans. Compon. Packag. Manuf. Technol.* **5:**9, 1201-1218 (2015)

[5] X. Sheng†, C. Robert†, **S. Wang**, G. Pakeltis, B. Corbett*, and J. A. Rogers*, "Epitaxial release and transfer printing of fully formed thin-film microscale gaas lasers on silicon with a thermally conductive interface material," *Laser & Photonics Reviews*, **9:**4, L1-L6 (**cover feature article**, 2015)

[4] **Y. Su†, S. Wang†, Y. Huang†**, H. Luan, W. Dong, J. Fan, Q. Yang, J. A. Rogers, and Y. Huang, "Elasticity of fractal inspired interconnects," *Small*, **11:**3, 363-373 | DOI: 10.1002/smll.201401181 (2015)

[3] C. Yu, Y. Li, X. Zhang, X . Huang, V. Malyarichuk, **S. Wang**, Y. Shi, L. Gao, Y. Su, Y. Zhang, H. Xu, R. Hanlon, Y. Huang, and J. A. Rogers*, "Adaptive optoelectronic camouflage systems with designs inspired by cephalopod skins", *Proceedings of the National Academy of Sciences USA* **111:**36, 12998-13003 (2014)

[2] X. Sheng, M. H. Yun, C. Zhang, A. M. Al-Okaily, M. Masouraki, L. Shen, **S. Wang**, W. L. Wilson, J. Y. Kim, P. Ferreira, X. Li, E. Yablonovitch, and J. A. Rogers*, "Device Architectures for Enhanced Photon Recycling in Thin-Film Multijunction Solar Cells," *Advanced Energy Materials*, **5:**1, 1400919 | DOI: 10.1002/aenm.201400919 (2014)

[1] H. Cheng and **S. Wang***, "Mechanics of Interfacial Delamination in Epidermal Electronics Systems," *Journal of Applied Mechanics* **81:**4, article 044501 | DOI: 10.1115/1.4025305 (2014)

Previous Journal Articles Publications

[22] Y. Su, Z. Liu, **S. Wang**, R. Ghaffari, D.-H. Kim, K.-C. Hwang, J. A. Rogers*, and Y. Huang*, "Mechanics of Stretchable Electronics on Balloon Catheter under Extreme Deformation", *International Journal of Solids and Structures* **51:**7-8, 1555-1561 (2014)

[3] Authors marked with † contribute equally as co-first authors. Same for the other publications in this CV.

[21] X. Sheng†, C. A. Bower†, S. Bonafede, J. W. Wilson, B. Fisher, M. Meitl, H. Yuen, **S. Wang**, L. Shen, S. Burroughs, and J. A. Rogers, "Printing-based assembly of quadruple-junction four-terminal microscale solar cells and their use in high-efficiency modules", *Nature Materials* **13**:6, 593-598 (2014)

[20] **Y. Zhang†, S. Wang†**, X. Li, J. A. Fan, S. Xu, Y. M. Song, K.-J. Choi, W.-H. Yeo, W. Lee, S. N. Nazaar, B. Lu, L. Yin, K.-C. Hwang, J. A. Rogers*, and Y. Huang*, "Experimental and Theoretical Studies of Serpentine Microstructures Bonded to Prestrained Elastomers for Stretchable Electronics," *Advanced Functional Materials* **24:**14, 2028-2037 (2014)

[19] **H. Xu†, C. Yu†, S. Wang†**, V. Malyarchuk, T. Xie*, and J. A. Rogers*, "Deformable, Programmable, and Shape-Memorizing Micro-Optics", *Advanced Functional Materials*, **23**:26, 3299-3306 (2013)

[18] W.-H. Yeo†, Y.-S. Kim†, J. Lee, A. Ameen, L. Shi, M. Li, **S. Wang**, R. Ma, S. H. Jin, Z. Kang, Y. Huang, and J. A. Rogers*, "Multifunctional Epidermal Electronics Printed Directly Onto the Skin", *Advanced Materials*, **25**:20, 2773-2778 (2013)

[17] **D.-H. Kim†, R. Ghaffari†, N. Lu†, S. Wang†**, S. P. Leeb, H. Keume, R. D'Angelo, L. Klinker, Y. Su, C. Lu, Y.-S. Kim, A. Ameen, Y. Li, Y. Zhang, B. de Graff, Y.-Y. Hsu, Z. Liu, J. Ruskin, L. Xu, C. Lu, F. G. Omenetto, Y. Huang, M. Mansour, M. J. Slepian, and J. A. Rogers*, "Electronic Sensor and Actuator Webs for Large-Area Cardiac Mapping and Therapy", *Proceedings of the National Academy of Sciences USA*, **109**:49 19910-19915 (2012)

[16] **A. Carlson†, S. Wang†**, P. Elvikis, P. M. Ferreira, Y. Huang*, and J. A. Rogers*, "Active, Programmable Elastomeric Surfaces with Tunable Adhesion for Deterministic Assembly by Transfer Printing", *Advanced Functional Materials* **22:**21, 4476-4484 (2012)

[15] D.-H. Kim, **S. Wang**, H. Keum, R. Ghaffari,Y.-S. Kim, H. Tao, B. Panilaitis, M. Li, Z. Kang, F. Omenetto, Y. Huang, and J. A. Rogers*, "Thin, Flexible Sensors and Actuators as 'Instrumented' Surgical Sutures for Targeted Wound Monitoring and Therapy", *Small* **8**:21, 3263-3268 (2012)

[14] J. Park, **S. Wang**, M. Li, C. Ahn, J. K. Hyun, D. S. Kim, D. K. Kim, J. A. Rogers, Y. Huang, and S. Jeon*, "Three-dimensional Nanonetwork for Giant Stretchability in Dielectrics and Conductors", *Nature Communications* **3**:916, 1-8 | DOI: 10.1038/ncomms1929 (2012)

[13] **S. Wang**, M. Li, J. Wu, D.-H. Kim, N. Lu, Y. Su, Z. Kang, Y.Huang*, and J. A. Rogers*, "Mechanics of Epidermal Electronics", *Journal of Applied Mechanics* **79**:3, article 031022 (2012)

[12] D.-H. Kim†, N. Lu†, R. Ma†, Y.-S. Kim, R.-H. Kim, **S. Wang**, J. Wu, S. M. Won, H. Tao, A. Islam, K. J. Yu, T.-I. Kim, R. Chowdhury, M. Ying, L. Xu, M. Li, H.-J. Chung, H. Keum, M. McCormick, P. Liu, Y.-W. Zhang, F. G. Omenetto, Y. Huang, T. Coleman, and J. A. Rogers*, "Epidermal Electronics", *Science* **333**:6044, 838-843 (2011)

[11] A. J. Baca†, K. J. Yu†, J. Xiao, **S. Wang**, J. Yoon, J. H. Ryu, D. Stevenson, R. G. Nuzzo, A. A. Rockett, Y. Huang, and J. A. Rogers*, "Compact Monocrystalline Silicon Solar

Modules with High Voltage Outputs and Mechanically Flexible Designs", *Energy & Environmental Science* **3**:2, 208-211 (**cover feature article**, 2010)

[10] **S. Wang**, J. Xiao, J. Song, H. C. Ko, K.-C. Hwang, Y. Huang, and J. A. Rogers, "Mechanics of Curvilinear Electronics", *Soft Matter* **6**, 5757–5763 (2010)

[9] G. Shin, I. Jung, V. Malyarchuk, J. Song, **S. Wang**, H. C. Ko, Y. Huang*, J. S. Ha*, and J. A. Rogers*, "Micromechanics and Advanced Designs for Curved Photodetector Arrays in Hemispherical Electronic Eye Cameras", *Small* **6**:7, 851-856 (2010)

[8] H. C. Ko, G. Shin, **S. Wang**, M. P. Stoykovich, J. W. Lee, D. Kim, J. S. Ha*, Y. Huang*, K.-C. Hwang, and J. A. Rogers*, "Curvilinear Electronics Formed Using Silicon Nanomembrane Cricuits and Elastomeric Transfer Elements", *Small*, **5**:23, 2703-2709 (**cover feature article**, 2009)

[7] T.-H. Kim, A. Carlson, J. H. Ahn, S. M. Won, **S. Wang**, Y. Huang, and J. A. Rogers*, "Kinetically Controlled, Adhesiveless Transfer Printing Using Microstructured Stamps", *Applied Physics Letters*, Letter **94**, article 113502 (2009)

[6] **S. Wang**, J. Xiao, I. Jung, J. Song, H. C. Ko, M. P. Stoykovich, Y. Huang*, K.-C. Hwang, and J. A. Rogers*, "Mechanics of Hemispherical Electronics", *Applied Physics Letters*, Letter **95**, article 181912 (**APL's 50th Anniversary Editor's Picks**, 2009)

[5] J. Song, Y. Huang, J. Xiao, **S. Wang**, K.-C. Hwang, H. C. Ko, D.-H. Kim, M. P. Stoykovich, and J. A. Rogers*, "Mechanics of Non-Coplanar Mesh Design for Stretchable Electronic Circuits", *Journal of Applied Physics*, **105**:12, article 123516 (2009)

[4] H. C. Ko†, M. P. Stoykovich†, J. Song, V. Malyarchuk, W. M. Choi, C.-J. Yu, J. B. Geddes III, J. Xiao, **S. Wang**, Y. Huang*, and J. A. Rogers*, "A Hemispherical Electronic Eye Camera Based on Compressible Silicon Optoelectronics", *Nature* **454**:7205, 748-753 (**cover feature article**, 2008)

[3] **S. Wang**, J. Song, D. H. Kim, Y. Huang*, and J. A. Rogers*, "Local Versus Global Buckling of Thin Films on Elastomeric Substrates", *Applied Physics Letters*, Letter **93**, article 023126 (2008)

[2] S.-I. Park, J. Ahn, X. Feng*, **S. Wang**, Y. Huang, and J. A. Rogers*, "Theoretical and Experimental Studies of Bending of Inorganic Electronic Materials on Plastic Substrates", *Advanced Functional Materials* **18**:18, 2673-2684 (2008)

[1] J. Yoon†, A. J. Baca†, S. Park, P. Elvikis, J. B. Geddes, L. Li, R. H. Kim, J. Xiao, **S. Wang**, T. H. Kim, M. J. Motala, B. Y. Ahn, E. Duoss, J. A. Lewis, R. G. Nuzzo, P. M. Ferreira, Y. Huang, A. Rockett, and J. A. Rogers*, "Ultrathin Silicon Solar Microcells for Semitransparent, Mechanically Fexible and Microconcentrator Module Designs", *Nature Materials* **7**, 907-915 (**cover feature article**, 2008)

Book Chapters

[2] **S. Wang**, J. Xiao, J. Song, Y. Huang, and J. A. Rogers, a chapter in the book "*Nano and Cellular Mechanics*" edited by H. D. Espinosa, Wiley, Chapter 13, 339-358 (2013)

[1] J. Song and **S. Wang**, a chapter in the book "*Stretchable Electronics*" edited by T. Someya, Wiley-VCH, Chapter 1, 3-29 (2012)

Presentations

Invited Talks

[9] SES 2017 Annual Technical Conference, Boston, MA, USA (2017)

[8] Boston University, Boston, MA (2014)

[7] Clemson University, Clemson, SC (2014)

[6] Utah State University, Logan, UT (2014)

[5] Gordon Research Seminar on Adhesion Science, Lewiston, ME, USA (2011)

[4] Sun Yat-Sen Univeristy, Guangzhou, China (2011)

[3] Peking University, Beijing, China (2011)

[2] Intl. Conference on Multiscale Modeling & Simulation, Guangzhou, China (2010)

[1] Symposium on Piezoelectricity, Wuhan, China (2009)

Conference Talks

[4] ASME International Mechanical Engineering Congress and Exposition (2011, 2014–2018)

[3] SES 2017 Annual Technical Conference (2011, 2014–2017)

[2] ASME Applied Mechanics and Materials Conference (2010, 2014)

[1] Material Research Society Spring Meeting, San Francisco, CA, USA (2010)

Academic Services & Activities

Journal Reviews

(1) ACS Applied Materials & Interfaces; (2) Acta Mechanica; (3) International Journal of Solids and Structures; (4) Nanotechnology; (5) Mechanics of Materials; (6) Journal of Applied Mechanics; (7) Journal of Physics: Condensed Matter; (8) Journal of Physics D: Applied Physics; (9) IEEE Transactions on Nanotechnology; (10) eXPRESS Polymer Letters; (11) Computational Materials Science; (12) Recent Patents on Engineering; (13) Journal of Applied Physics; (14) Journal of Engineering Mathematics; (15) Proceedings of the Royal Society A; (16) Journal of Micromechanics and Microengineering; (17) Applied Mathematical Modelling; (18) Computational Mechanics; (19) Extreme Mechanics Letters; (20) IEEE Transactions on Components, Packaging and Manufacturing Technology; (21) International Journal of Mechanical Sciences; (22) Scientific Reports; (23) Theoretical and Applied Mechanics Letters;

(24) Research & Reviews: Journal of Engineering and Technology; (25) International Journal of Applied Mechanics; (26) Science China Technological Sciences; (27) Advanced Materials; (28) Composite Structures; (29) Applied Thermal Engineering; (30) Applied Sciences; (31) Advanced Functional Materials; (32) Thin-Walled Structures; (33) Polymer Testing; (34) Journal of Manufacturing Processes; (35) Materials; (36) Micromachines.

Conference Organization

[10] Symposium Organizer, ASME International Mechanical Engineering Congress and Exposition, Pittsburgh, PA, USA (2018)

[9] Symposium Organizer, ASME International Mechanical Engineering Congress and Exposition, Tampa, FL, USA (2017)

[8] Symposium Section Chair, Society of Engineering Science 54th Annual Technical Meeting, Northeastern University, Boston, MA, USA (2017)

[7] Topic Organizer and Section Chair, ASME International Mechanical Engineering Congress and Exposition, Phoenix, AZ, USA (Nov 2016)

[6] Symposium Organizer and Section Chair, Society of Engineering Science 53rd Annual Technical Meeting, University of Maryland, College Park, MD, USA (2016)

[5] Section Chair, ASME International Mechanical Engineering Congress and Exposition, Houston, TX, USA (Nov 2015)

[4] Symposium Organizer and Section Chair, Society of Engineering Science 52nd Annual Technical Meeting, Texas A&M University, College Station, TX, USA (2015)

[3] Track Organizer and Section Chair, ASME Applied Mechanics and Materials Conference, Seattle, WA, USA (2015)

[2] Section Chair, ASME International Mechanical Engineering Congress and Exposition, Montreal, Canada (Nov 2014)

[1] Section Chair, SES 2011 Annual Technical Conference, Evanston, IL, USA (Oct 2011)

Profesional Technical Committee Roles

[2] Vice Chair, ASME Material Division Electronic Materials Technical Committee (2017-2019)

[1] Secretary, ASME Applied Mechanics Division Elasticity Technical Committee (2017-2019)