ANDREW J. GROSS

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EDUCATION

Harvard University September 2015 - present
Postdoctoral Fellow in the School of Engineering and Applied Sciences
Faculty Advisor: Katia Bertoldi
Project: Nano-architected materials

The University of Texas at Austin August 2010 - August 2015
Ph.D. in Aerospace Engineering
Advisor: K. Ravi-Chandar
Thesis: Towards the predictive modeling of ductile failure

Iowa State University August 2006 - May 2010
B.S. in Aerospace Engineering

RESEARCH EXPERIENCE

Nano-architected materials

- Investigate the elastic properties of lattice-truss architectures through computational analysis
  - Create a code to automatically build and analyze finite element models of periodic lattice-truss materials with general architecture
  - Compute stiffness and strength for diverse architectures to correlate architectural parameters with mechanical properties
  - Examine post-buckling response to determine architectures with collapse response that gives rise to novel material properties
- Fabrication of nano-architected materials with two-photon lithography
  - Create a python package to automatically generate optimized laser trajectories for diverse geometries
  - Establish a technique to incorporate temporary support structures to expand the design domain
  - Develop a technique that modifies or removes structures after pyrolytic miniaturization
- Mechanical testing of nano-architected materials with *in situ* scanning electron microscopy

Inverse methods for material characterization

- Integrated full-field experimental data sets with simulation results to extract material constitutive properties from specimens with inhomogeneous states of deformation
- Inclusion of full-field data to calibrate models for plastic anisotropy increased model accuracy while decreasing the number of experiments required
- Investigated the effect of objective function formulation to reveal that objective function selection is critical to find the best solution
- Proposed a new class of objective functions that outperform conventional formulations by applying non-uniform weights to the full-field data that prioritize unique information

Multiscale material characterization

- Examined the micro and macro scale deformation and failure behavior of structural metals
- Designed and executed novel experiments that employed *in situ* scanning electron microscopy to directly observe the evolution of matrix/defect interactions and their relation to the initiation of cracks
- Correlated micro-mechanical mechanisms of deformation and failure to macroscopic response in order to make conclusions that pertain to continuum modeling

- Prepared samples with traditional metallographic techniques for postmortem analysis

Modeling, validation, and verification

- Produced top tier predictions for the first two Sandia fracture challenges
- Investigated differences between predictions and experiments to reveal the need for extremely accurate plasticity models in order to improve the capabilities of predictive failure modeling
- Uncovered experimental details undetected by the fracture challenge community that ultimately led to a complete reinterpretation of the results

Nondestructive evaluation

- Designed and fabricated fiberglass reinforced plastic plates with engineered defects
- Assisted in measuring the embedded defects with air-coupled ultrasound
- Rapidly designed and fabricated a device to mobilize the ultrasound setup out of the lab and into the field for testing of production wind turbine blades in response to the urgent needs of the project's industrial sponsor

PUBLICATIONS

Submitted Manuscripts

1. Vasios, N., Gross, A., Soifer, S., Overvelde, J., & Bertoldi, K. (2018). Harnessing viscous flow to simplify the actuation of fluidic soft robots. *Submitted manuscript*.

2. Gross, A., Pantidis, P., Bertoldi, K., & Gerasimidis, S. (2018). Correlation between topology and elastic properties of imperfect truss-lattice materials. *Submitted manuscript*.

Manuscripts in preparation

3. Gross, A., & Bertoldi, K. (2018). Additive manufacturing of nano-structures that are delicate, complex, and smaller than ever. *Manuscript in preparation*.

4. Gross, A., & Bertoldi, K. (2018). Effective properties of truss-lattice materials across a large range of geometric configurations. *Manuscript in preparation*.

Published journal articles

5. Gross, A., & Ravi-Chandar, K. (2017). On the deformation and failure of Al 6061-T6 in plane strain tension evaluated through in situ microscopy. *International Journal of Fracture*, 1–26.

6. Gross, A., & Ravi-Chandar, K. (2016). On the deformation and failure of Al 6061-T6 at low triaxiality evaluated through in situ microscopy. *International Journal of Fracture*, *200*(1-2), 185–208.

7. Boyce, B., ..., Gross, A., et al. (2016). The second sandia fracture challenge: predictions of ductile failure under quasi-static and moderate-rate dynamic loading. *International Journal of Fracture*, *198*(1-2), 5–100.

8. Gross, A., & Ravi-Chandar, K. (2016). Prediction of ductile failure in Ti–6Al–4V using a local strain-to-failure criterion. *International Journal of Fracture*, *198*(1-2), 221–245.

9. Gross, A., & Ravi-Chandar, K. (2015). On the extraction of elastic–plastic constitutive properties from three-dimensional deformation measurements. *Journal of Applied Mechanics*, *82*(7), 071013.

10. Boyce, B. L., ..., Gross, A., et al. (2014). The sandia fracture challenge: blind round robin predictions of ductile tearing. *International Journal of Fracture*, *186*(1-2), 5–68.

11. Gross, A., & Ravi-Chandar, K. (2014). Prediction of ductile failure using a local strain-to-failure criterion. *International Journal of Fracture*, *186*(1-2), 69–91.

TEACHING EXPERIENCE

Assistant Instructor - The University of Texas at Austin

- Developed and taught a course on mechanics of materials with approximately 100 students
- Managed a team of teaching assistants

Teaching Assistant - The University of Texas at Austin

- Managed laboratory setup and led laboratory sessions for a course on measurements (4 semesters)
- Led laboratory sessions for a course on material property testing (1 semester)
- Conducted recitation sessions for a mechanics of materials course (3 semesters)

SELECTED PRESENTATIONS

1. Gross, A. and Bertoldi, K. Ultralight, Highly Compressible Nanoscale Lattice-Truss Materials, *European Solid Mechanics Conference*, Bologna, Italy, July 2, 2018.
2. Gross, A. and Bertoldi, K. Ultralight, Highly Compressible Nanoscale Lattice-Truss Materials, *ASME International Mechanical Engineering Congress and Exposition*, Tampa, FL, Nov. 8 2017.
3. Gross, A. and Bertoldi, K. Fabrication and Mechanical Properties of Slender Nanoscale Lattice-Truss Materials, *Society of Engineering Science*, Boston, MA, July 27, 2017.
4. Gross, A. and Bertoldi, K. Design, fabrication, and testing of low-density, high-strength, defect resistant materials, *ASME International Mechanical Engineering Congress and Exposition*, Phoenix, AZ, Nov. 17 2016.
5. Gross, A., and K. Bertoldi, Design fabrication, and testing of low-density, high strength materials, *Society of Engineering Science*, Hyattsville, MD, Oct. 3, 2016.
6. Gross, A., and Ravi-Chandar, K. Confronting the ambiguity of inverse methodologies: the role of the objective function, *Society for Experimental Mechanics*, Costa Mesa, CA, June 9, 2015.
7. Gross, A. and Ravi-Chandar, K. On the extraction of elastic-plastic constitutive properties from three-dimensional deformation measurements, *AmeriMech Symposium*, Austin, TX, Dec. 12, 2014.
8. Gross, A. and Ravi-Chandar, K. Coupling full field deformation measurements and FEM for material characterization, *Society for Experimental Mechanics*, Greenville, SC, June 4, 2014.
9. Gross, A. and Ravi-Chandar, K. Extraction of material properties from 3-D deformation measurements, *ASME International Mechanical Engineering Congress and Exposition*, San Diego, CA, Nov. 18, 2013.

INVITED TALKS

1. Design, Fabrication, and Testing of Nano-Architected Truss-Lattice Materials, University of Massachusetts Amherst, *Scheduled Oct. 26, 2018*
2. Nano-Architected Materials – Investigation of Truss-Lattice Systems, Missouri University of Science and Technology, March 2, 2018

PEER REVIEWER AFFILIATIONS

Proceedings of the National Academy of Sciences
International Journal of Solids and Structures
Applied Physics A
International Journal of Fracture

AWARDS AND HONORS

Max L. Williams Fellowship (2013)
Eugene A. Ripperger Fellowship (2012)
University of Texas Professional Development Award (2012, 2014)
Center for Mechanics of Structures, Solids, and Materials Travel Grant (2013)