

MEM 238 Dynamics

- Led recitation sessions focused on reviewing the basic concepts of rigid body dynamic structures.

MEM 331 Experimental Mechanics

- Designed and led experiments in the lab to demonstrate the concepts learned in various Statics, Dynamics, and Mechanics of Materials courses.
- Instructed students how to write lab reports in a clear, concise manner consistent with journal publication rules.

RESEARCH EXPERIENCE

Lab Manager, Mechanical and Structural Testing Facility November 2017 – Present

- Work with vendors to install and setup mechanical testing equipment
- Develop procedures for all equipment and safety practices
- Assist with designing experiments performed with the equipment

Postdoctoral Research Fellow, Theoretical & Applied Mechanics Group October 2017 – Present

Projects: **SBIR: Health Conscious Structures for Zero-Maintenance Rotorcraft Platforms**

- Perform fatigue and vibrational testing of Al and composite specimens.
- Develop damage evolution curves for the materials to be applied to a FEM modeling framework for remaining life estimations
- Perform validation on a full size component

Local Microstructure Effect on Fracture in Precipitate Hardened Al Alloys

- The effect of particle stoichiometry and geometry are investigated using CP-FEM models informed from experiments.
- Surrounding grain orientation is investigated for its effect on strain localizations that lead to fracture.
- In situ x-ray microcomputed tomography is coupled with AE data to detect and identify the evolution of subsurface damage.

Acoustic Emission of Dislocation Motion in Cu Single Crystals

- Pure Cu single and poly crystals are compression tested to identify AE activity.
- Cu single crystals are nanoindented to induce dislocation motion which is recorded by AE.

Research Assistant, Theoretical & Applied Mechanics Group March 2014 – September 2017

Lead Experimentalist, 2015- Present

Projects: **In situ SEM-DIC-AE NDE Technique Development**

- Used a custom SEM door to pass AE signals obtained inside the SEM through the door for in situ SEM monitoring of the microstructure while recording the corresponding AE hits.
- Used materials with varying particle size and application methods to achieve high electrical contrast for DIC with SEM images. Methods include particle deposition and microstamping.

Damage Precursor Identification in Light Metal Alloys

- Implemented AE and DIC techniques coupled with SEM observation to identify the earliest signs of damage in Al alloys, including particle fracture.
- Leveraged DIC strain evolution maps to reveal the driving force of these mechanisms based on dislocation motion and strain build ups at particle sites prior to damage.

- Performed AE classification and outlier analysis to identify the onset of damage, the type of damage, and help predict remaining useful life.
- Investigated the effect of twinning in Mg alloy AZ31 from single crystals to polycrystals to identify the AE signature of twinning for material state awareness.

Damage Detection and Evolution in 3D Woven Composites

- Combined ASTM Standard testing with Stereo DIC and AE monitoring to study the damage mechanisms and evolution of 3D woven composites.
- Conducted X-ray micro CT scans was conducted to validate the information obtained from AE as indicating damage present sub surface.

Degradation of Concrete from Impingement of NaCl during Freezing Cycles

- Used a combined acoustic emission and ultrasonic testing technique to investigate damage evolution in a concrete specimen subjected to freezing and thawing cycles while soaking in a NaCl solution.
- Implemented AE as a structural health monitoring tool live during the loads while the ultrasonic testing is performed after thawing as a nondestructive technique to measure the level of damage in the material.

Development of a Tobacco Mosaic Virus DIC Speckle Method

- Used a naturally structured system to produce contrast for DIC, the technique of applying the pattern allows for a microscale DIC pattern to be developed over the entire specimen in a small amount of time.
- Identified limits of the technique, including the mismatch of the virus base coat required to adhere the virus to the test material.

Student Intern, Sandia National Labs Org 1851

December 2015 – January 2016

Projects:

Development of a Gold Remodeled DIC Pattern for In Situ SEM Application

- A sputter-coated nanometer thick gold film was naturally remodeled using heat and humidity to form a micro-scale DIC pattern on a large sample area in a short amount of time.
- Identified key parameters to a successful controllable pattern including the humidity level and time exposed as well as the gold film thickness.

Development of an SEM Distortion Correction Algorithm

- Developed a code to correct for spatial distortion obtained during SEM imaging based on a series of rigid body motions.
- Extended the code to account for drift distortion based on repeated images of the same area taken over time.

Research Assistant, MiNED

September 2011 – June 2013

Projects:

Real Space Materials Knowledge System Implementation using Bayesian Statistics

- Evaluated microstructure effectiveness based on the desired material properties in real space to determine the effects of the periodic boundary conditions imposed by the FFT formulation used to de-convolve time and space.
- Proposed Bayesian Updating to increase the speed and reliability of the method by using prior knowledge of the system.

Research Assistant, Army Research Labs, Aberdeen

September 2012 – December 2012

Projects:

Machine Learning Algorithm for Optimum Chromophore Selection

- Identified the optimum chromophore using clustering to obtain the desired properties while considering the ability to synthesize the chromophore.

INDUSTRY EXPERIENCE

Piasecki Aircraft Corporation, Essington, Pennsylvania January 2013 – September 2015
Job Title: Mechanical Engineer and Configuration Manager
Responsibilities: Designed structural components for various projects. Created and managed a configuration control system to ensure everyone was working with the latest approved designs to obtain 9001 compliance.

Schramm Inc., West Chester, Pennsylvania January 2010 – August 2010
Job Title: Manufacturing Engineer, Co-op
Responsibilities: Developed solutions for problems arising between design and manufacturability. Designed new tooling and inspection equipment as well as new manufacturing facilities. Established work instructions for API certification.

AWARDS

2016 AEWG Student Paper Competition Winner
2015-2016 Kling Lindquist Partnership Engineering Fellowship
2011 The Association of Engineering Colleges of Pennsylvania Award
2010 Boeing Scholarship

COMPUTER SKILLS

SolidWorks, Microsoft Office, Matlab, AutoCAD, ProENGINEER, Abaqus, MeshLab, ARAMIS, VIC 3D

TECHNICAL SKILLS

Optical Microscope, SEM Microscope, Nanoindentation, Digital Image Correlation, Acoustic Emission, X-ray Microcomputed Tomography, Mechanical Testing and Characterization

JOURNAL PUBLICATIONS

Under Review

- J9. 2018 K. Mazur, **B. Wisner** and A. Kotsos. "Fatigue Damage State Identification via Signal Processing and Clustering of Nondestructive Data." Submitted to *Journal of the Minerals, Metals & Materials Society* Special Issue.
- J8. 2018 **B. Wisner**, K. Mazur, and A. Kotsos. "An Acoustic Emission Signal Processing Framework to Identify Fracture in Aluminum Alloys." Submitted to *Engineering Fracture Mechanics*.

Published

- J7. 2017 K. Baxevanakis, **B. Wisner**, S. Schlenker, H. Baid, and A. Kotsos. "Data-driven Damage Model based on Nondestructive Evaluation." *The Journal of Nondestructive Evaluation, Diagnostics and Prognostics of Engineering Systems*. Accepted 28 March 2018.
- J6. 2018 F. Althoey, **B. Wisner**, A. Kotsos, and Y. Farnam. "Cementitious Materials Exposed to High Concentration of Sodium Chloride Solution: Formation of A Deleterious Chemical Phase Change." *Construction & Building Materials*, vol. 167, pp. 543-552.
- J5. 2018 **B. Wisner** and A. Kotsos. "Investigation of Particle Fracture during Fatigue of Aluminum 2024." *International Journal of Fatigue*, vol. 111, pp.33-43.

- J4. 2017 **B. Wisner** and A. Kontsos. "In situ monitoring of particle fracture in aluminium alloys." *Fatigue & Fracture of Engineering Materials & Structures*, vol 43, pp.581-596.
- J3. 2017 N. Castaneda, **B. Wisner**, et al. "Investigation of the Z-binder Role in Progressive Damage of 3D Woven Composites." *Composites Part A: Applied Science and Manufacturing*, vol. 98, pp. 76-89, 2017.
- J2. 2016 C. Mo, **B. Wisner**, M. Cabal, K. Hazeli, K.T. Ramesh, H. El Kadiri, T. Al-Samman, K.D. Molodov, D.A. Molodov, A. Kontsos. "Acoustic Emission of Deformation Twinning in Magnesium." *Materials*, vol. 9, pp. 662, 2016.
- J1. 2015 **B. Wisner**, M. Cabal, P. A. Vanniamparambil, J. Hochhalter, W. P. Leser, and A. Kontsos, "In Situ Microscopic Investigation to Validate Acoustic Emission Monitoring." *Experimental Mechanics*, vol. 55, pp. 1705-1715, 2015.

CONFERENCE PROCEEDINGS

- C7. 2018 **B. Wisner**, K. Mazur, M. Bahadori, M. Shehu, H. Baid, A. Kontsos, F. Abdi, "Data-driven Composite Damage Prognostics by Coupling Computational Modeling with Nondestructive Evaluation" SAMPE 2018, Long Beach, CA, May 2018.
- C6. 2017 R. Haynes, E. Habtour, T. Henry, D. Cole, A. Kontsos, and **B. Wisner**, "Damage Precursor Indicator for Aluminum 7075-T6 based on Nonlinear Dynamics" 36th Conference and Exposition on Structural Dynamics of Multiphysical Systems, 12 February 2018.
- C5. 2017 **B. Wisner** and A. Kontsos, "Fatigue Damage Precursor Identification using Nondestructive Evaluation Coupled with Electron Microscopy." In: Zehnder A. et al. (eds) *Fracture, Fatigue, Failure and Damage Evolution*, Volume 8. Conference Proceedings of the Society for Experimental Mechanics Series. Springer, Vol. 8, pp 1-8.
- C4. 2016 N.A. Castaneda, **B. Wisner**, J. Cuadra, and A. Kontsos, "Identification of 4D Damage Precursors in 3D Woven Composites." 31st American Society of Composites Conference and ASTM D30 Meeting 2016, Williamsburg VA, September 2016.
- C3. 2016 D. Christe, **B. Wisner**, J. Bhatt, and A. Kontsos, "Raising Interest in STEM Education (RISE): A Community College-University Partnership for Engaging Minorities in STEM." American Society for Engineering Education, 26 June 2016.
- C2. 2016 **B. Wisner**, and A. Kontsos, "Microstructure-Sensitive Acoustic Emission." Acoustic Emission Working Group, 24 May 2016.
- C1. 2015 **B. Wisner**, M. Cabal, P. A. Vanniamparambil, J. Hochhalter, W. P. Leser, and A. Kontsos, "Identification of Acoustic Emission Sources Using in Situ Microscopy." Society for the Advancement of Material and Process Engineering, 18-24 May 2015.

INVITED TALKS

- I1. 2018 **B. Wisner** "Damage State Identification by Coupling Microstructure-Sensitive Nondestructive Evaluation with Machine Learning Tools." Montana State University, 26 February 2018.

PRESENTATIONS

- P10. 2018 **B. Wisner**, K. Mazur, and A. Kontsos, "Identification of fatigue weak links in Aluminum alloys using a data-driven approach." The Minerals, Metals & Materials Society, 12 March 2018.

- P9. 2017 **B. Wisner**, K. Mazur, and A. Kontsos, "Coupling In Situ Microstructure Observation with Machine Learning Algorithms for Damage Diagnostics and Prognostics." The International Workshop on Structural Health Monitoring, 13 September 2017.
- P8. 2017 **B. Wisner** and A. Kontsos, "Fatigue Damage Precursor Identification using Nondestructive Evaluation Coupled with Electron Microscopy." The Society for Experimental Mechanics, 14 June 2017.
- P7. 2017 **B. Wisner**, K. Baxevanakis, and A. Kontsos, "The Role of Particle Fracture in Aluminum Alloys." The Minerals, Metals, and Materials Society, 28 February 2017.
- P6. 2016 **B. Wisner**, and A. Kontsos, "Microstructure-Sensitive Acoustic Emission." Acoustic Emission Working Group, 24 May 2016.
- P5. 2016 **B. Wisner**, K. Baxevanakis, R. Whitmore, S. Rajaram, and A. Kontsos, "Computationally-driven Damage in Structures from Microstructure-based Damage Mechanisms." Society of Engineering Science, 3 October 2016.
- P4. 2016 **B. Wisner** and A. Kontsos, "Microstructure-Sensitive Investigation of Aluminum 2024 damage Precursors using Acoustic Emission." The Minerals, Metals, and Materials Society, 15 February 2016.
- P3. 2015 **B. Wisner**, et. al, "Microstructure-Sensitive Investigation of Fracture using Acoustic Emission Coupled with Electron Microscopy." Society for Experimental Mechanics, 21 May 2015.
- P2. 2015 **B. Wisner**, et. al, "Microstructure-Sensitive Investigation of Fracture using Acoustic Emission Coupled with In Situ Electron Microscopy." Acoustic Emission Working Group, 13-15 May 2015.
- P1. 2015 **B. Wisner**, et. al., "Identification of Acoustic Emission Sources Using In Situ Microscopy." Society for the Advancement of Material and Process Engineering, 18-24 May 2015.

PROFESSIONAL ACTIVITIES

- **Conference Organizer:** *Materials Instability: Quantification, Constitutive Response, and Prediction* in TAM 2108
- **Reviewer** for ASME Journal of Engineering Materials and Technology; Journal of Minerals, Metals & Materials Special Edition
- **Member** of Society for Experimental Mechanics, Tau Beta Pi, American Society of Mechanical Engineers, Association for Iron and Steel Technology, American Society for Metals International, The Minerals, Metals, and Materials Society

COLLAORATORS

Hochhalter, Jacob (NASA Langley), Carroll, Jay (Sandia National Labs), Sause, Markus (Augsburg University), Cuadra, Jefferson (Lawrence Livermore National Labs), Robert Haynes (Army Research Labs), Konstantinos Baxevanakis (Loughborough University), Gang Feng (Villanova University), Yaghoob Farnam (Drexel University)