

Hongyi Xu, Ph.D.

Assistant Professor

Mechanical Engineering Department & UTC Institute for Advanced Systems Engineering
University of Connecticut, Storrs, CT 06269
Phone: 860-486-2855, email: hongyi.3.xu@uconn.edu

EMPLOYMENT

Feb 2019 – present **Assistant Professor**, University of Connecticut, Storrs, CT, 06269
Jun 2014 – Feb 2019 **Research Engineer**, Research & Advanced Engineering, Ford Motor Company, Dearborn, MI, 48121

EDUCATION

Jun 2014 **Ph.D.**, Mechanical Engineering, Northwestern University, Evanston, IL, United States
Jul 2010 **M.S.**, Mechanical Engineering, Tsinghua University, Beijing, China
Jul 2008 **B.S.**, Mechanical Engineering and Automation, Northeastern University, Shenyang, China

RESEARCH PROJECTS OVER THE PAST 5 YEARS

Design for Additive Manufacturing considering material and manufacturing uncertainties (ongoing)

- Developed uncertainty quantification methods for the additively manufactured lattice structures
- Established a digital thread for the topology optimization and additive manufacturing of lattice-solid structures for lightweight vehicle components
- Initiated and leading a Ford University Research Project on cellular mesostructure system design (funded by Ford Motor Company)

Battery safety modeling (ongoing)

- Established a microstructure FEA modeling method to predict the behavior of battery separators under external loading
- Developed experimental methods for preparing stretched battery separator samples for Scanning Electron Microscopy (SEM)
- Proposed an image-based statistical characterization and stochastic reconstruction methods for modeling the microstructures of battery separators

Data mining-enhanced Multidisciplinary Design Optimization (2014-2019)

- Established a data mining strategy to improve the searching efficiency of the direct MDO (DMDO) algorithms
- Initiated and leading a Ford Research-IT collaboration project on optimization methods for carbon fiber composite structures
- Proposed a cokriging-based method to enhance the accuracy of multi-fidelity metamodels for the optimization of multi-material structures
- Developed a Gaussian process-based bias correction algorithm and software tool to improve the accuracy of metamodels for parametric geometry optimization
- Proposed multiple new metrics that helps the engineers evaluate the quality of the training data and the performance of the optimization results

Integrated Computational Materials Engineering (ICME) of carbon fiber composites for lightweight vehicles (2014-2018)

- Established a computational ICME workflow, which integrates the material processing simulation, composites microstructure models and structural simulations (stiffness, durability, strength, impact, etc.) into one automated process. This workflow serves as the tool for the ICME optimization of manufacturing parameters, material selections, material designs, and product structure designs.
- Proposed a new machine learning-based strategy for the optimization of multi-component, multi-layer composite structures
- Developed new microstructure reconstruction and modeling methods for the chopped fiber composites

BOOK CHAPTERS

- Bostanabad, R., Liang, B., van Beek, A., Gao, J., Liu, W. K., Cao, J., Zeng, D., Su, X., **Xu, H.**, Li, Y. and Chen, W., “Multiscale simulation of fiber composites with spatially varying uncertainties.” In *Uncertainty Quantification in Multiscale Materials Modeling*, pp. 355-384. Woodhead Publishing, 2020.

JOURNAL PUBLICATIONS

1. Tang, H., Chen, Z., Yan, W., Liu, Z., Sun, Q., Zhou, G., **Xu, H.**, Han, W., Su, X., "Computational Micromechanics Model based Failure Criteria for Chopped Carbon Fiber Sheet Molding Compound Composites", *Composites Science and Technology*, in printing
2. Pan, Z., Zhu, J., **Xu, H.**, Sedlatschek, T., Zhang, X., Li, W., Gao, T., Xia, Y., Wierzbicki, T., "Microstructural deformation patterns of a highly orthotropic polypropylene separator of lithium-ion batteries: Mechanism, model, and theory", *Extreme Mechanics Letters*, 37 (2020): 100705
3. **Xu, H.**, "Constructing Oscillating Function-based Covariance Matrix to allow Negative Correlations in Gaussian Random Field Models for Uncertainty Quantification", *Journal of Mechanical Design* (2020).
4. Liu, Z., **Xu, H.**, Zhu, P., "An adaptive multi-fidelity approach for design optimization of mesostructure-structure systems", *Structural and Multidisciplinary Optimization* (2020).
5. **Xu, H.**, Bae, C., "Stochastic 3D Microstructure Reconstruction and Mechanical Modeling of Anisotropic Battery Separators", *Journal of Power Sources*, 430 (2019): 67-73.
6. **Xu, H.**, Liu, Z., "Control variate multi-fidelity estimators for the variance and sensitivity analysis of mesostructure-structure systems", *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part B: Mechanical Engineering*, 5.2 (2019): 020907
7. Chen, Z., Tang, H., Shao, Y., Sun, Q., Zhou, G., Li, Y., **Xu, H.**, Zeng, D., Su, X., "Failure of chopped carbon fiber Sheet Molding Compound (SMC) composites under uniaxial tensile loading: Computational prediction and experimental analysis." *Composites Part A: Applied Science and Manufacturing*, 118 (2019): 117-130.
8. Yang, J., **Xu, H.**, Zhan, Z., Chuang, C-H., "A Structural Equation Modeling-Based Strategy for Design Optimization of Multilayer Composite Structural Systems", *Journal of Mechanical Design*, 140.11 (2018), 111407
9. Li, Y., Chen, Z., Su, L., Chen, W., Jin, X., **Xu, H.**, "Stochastic Reconstruction and Microstructure Modeling of SMC Chopped Fiber Composites", *Composite Structures*, 200 (2018): 153-164.
10. Bostanabad, R., Liang, B., Gao, J., Liu, W.K., Cao, J., Zeng, D., Su, X., **Xu, H.**, Li, Y., Chen, W., "Uncertainty quantification in multiscale simulation of woven fiber composites", *Computer Methods in Applied Mechanics and Engineering*, 338 (2018): 506-532.
11. Chen, Z., Huang, T., Shao, Y., Li, Y., **Xu, H.**, Avery, K., Zeng, D., Chen, W., Su, X., "Multiscale Finite Element Modeling of Sheet Molding Compound (SMC) Composite Structure based on Stochastic Mesostructure Reconstruction", *Composite Structures*, 188 (2018): 25-38.
12. **Xu, H.**, Zhu, M., Marcicki, J., and Yang, X. G., "Mechanical Modeling of Battery Separator based on Microstructure Image Analysis and Stochastic Characterization", *Journal of Power Sources*, 345 (2017): 137-145.
13. Li, Y., Chen, Z., **Xu, H.**, Dahl, J., Zeng, D., Mirdamadi, M. and Su, X., "Modeling and Simulation of Compression Molding Process for Sheet Molding Compound (SMC) of Chopped Carbon Fiber Composites", *SAE International Journal of Materials and Manufacturing*, 10, No. 2017-01-0228 (2017).
14. **Xu, H.**, Li, Y., and Zeng, D., "Process Integration and Optimization of ICME Carbon Fiber Composites for Vehicle Lightweighting: A Preliminary Development", *SAE International Journal of Materials and Manufacturing*, 10, No. 2017-01-0229 (2017).
15. Zheng, K., Yang, R., **Xu, H.**, and Hu, J., "A new distribution metric for comparing Pareto optimal solutions", *Structural and Multidisciplinary Optimization*, 55, no. 1 (2017): 53-62.
16. Hassinger, I., Li, X., Zhao, H., **Xu, H.**, Huang, Y., Prasad, A., Schadler, L., Chen, W. and Brinson, L.C., "Toward the development of a quantitative tool for predicting dispersion of nanocomposites under non-equilibrium processing conditions", *Journal of Materials Science*, 51.9 (2016), pp.4238-4249.
17. **Xu, H.**, Jiang, Z., Apley, D. W., and Chen, W., "New Metrics for Validation of Data-Driven Random Process Models in Uncertainty Quantification", *Journal of Verification, Validation and Uncertainty Quantification* 1, no. 2 (2016): 021002.
18. **Xu, H.**, Chuang, C., and Yang, R., "Towards Optimization of Multi-Material Structure: Metamodeling of Mixed-Variable Problems", *SAE International Journal of Materials and Manufacturing*, 9, no. 2016-01-0302 (2016): 400-409.
19. **Xu, H.**, Chuang, C., and Yang, R., "A Data Mining-Based Strategy for Direct Multidisciplinary Optimization." *SAE International Journal of Materials and Manufacturing* 8.2015-01-0479 (2015): 357-363.
20. **Xu, H.**, Liu, R., Choudhary, A. Chen, W., "A Machine Learning-based Design Representation Method for Designing Heterogeneous Microstructures", *Journal of Mechanical Design*, 137.5 (2015), 051403.
21. **Xu, H.**, Dikin, D., Chen, W., "Descriptor-based Methodology for Statistical Characterization and 3D Reconstruction for Polymer Nanocomposites", *Computational Material Science*, Vol. 85 (2014), 206-216.
22. **Xu, H.**, Li, Y., Brinson, L. C., Chen, W., "A Descriptor-based Design Methodology for Developing Heterogeneous Microstructural Materials System", *Journal of Mechanical Design*, 136.5 (2014): 051007 (JMD Editor's Choice Paper Award).
23. Majcher, M., **Xu, H.**, Chuang, C., Fu, Y., Yang, R. J., "A Comparative Benchmark Study of using Different Multi-Objective Algorithms for Restraint System Design", *SAE International journal of transportation safety* 2.2014-01-0564 (2014): 301-306.
24. **Xu, H.**, Greene, M. S., Deng, H., Dikin, D., Brinson, L. C., Liu, W. K., Burkhart, C., Papakonstantopoulos, G., Poldneff, M., Chen, W., "A Stochastic Reassembly Strategy for Managing Information Complexity in Heterogeneous Materials Analysis and

- Design”, *Journal of Mechanical Design*, 135(10), 2013.
25. C. M. Breneman, L.C. Brinson, L.S. Schadler, B. Natarajan, M. Krein, K. Wu, L. Morkowchuk, Y. Li, H. Deng, **H. Xu**, “Stalking the Materials Genome: A Data-driven Approach to the Virtual Design of Nanostructured Polymers”, *Advanced Functional Materials*, DOI: 10.1002/adfm.201301744, 2013.
 26. Greene, M. S., **Xu, H.**, Tang, S., Chen, W., Liu, W. K., “A generalized uncertainty propagation criterion from benchmark studies of microstructured material systems”, *Computer Methods in Applied Mechanics and Engineering*, 254, pp 271-291, 2012.
 27. Li, G., Zhang, C., **Xu, H.**, Luo, J., Liu, S., “The Film Behaviors of Grease in Point Contact during Micro-oscillation”. *Tribology Letters*, 38(3), pp 259-266, 2010.
 28. **Xu, H.**, Zhang, C.H., "Finite element analysis of roller bearing based on the plastic material models." *J. Mech. Eng.* 46.11 (2010): 29-35.

CONFERENCE PUBLICATIONS

1. Wang, Z., **Xu, H.**, Quantification of Uncertainties distributed in Network-like Systems, ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE) 2020, accepted.
2. Wang, Z., **Xu, H.**, Li, Y., “Material Model Calibration by Deep Learning for Additively Manufactured Alloys”, ASME 2020 International Symposium on Flexible Automation, ISFA2020-16724, accepted.
3. Li, Y., **Xu, H.**, Lai, W.J., Li, Z., Su, X., A Multiscale Material Modeling Approach to Predict the Mechanical Properties of Powder Bed Fusion (PBF) Metal, ASTM International's STP: Selected Technical Papers, Fourth ASTM Symposium on Structural Integrity of Additive Manufactured Materials & Parts, 2020, in printing.
4. Chen, Z., Wang, M., Shao, Y., Sun, Q., Tang, H., **Xu, H.**, Avery, K., Zeng, D., Su, X., “A Comparative Study of Two ASTM Shear Test Standards for Chopped Carbon Fiber SMC”, SAE Technical Paper 2018-01-0098, (2018)
5. Yang, J., Chuang, C.H., Zhan, Z., Fang, Y., **Xu, H.** and Guo, G., *A Data Mining and Optimization Process with Shape and Size Design Variables Consideration for Vehicle Application* (No. 2018-01-0584). SAE Technical Paper (2018).
6. Liu, Z., Zhu, P., Wang, L., Chuang, C.H. and **Xu, H.**, Multidisciplinary optimization of auto-body lightweight design using hybrid metamodeling technique and particle swarm optimizer. *SAE International Journal of Materials and Manufacturing*, 11(4), pp.373-384, (2018)
7. **Xu, H.**, Yang, J., Chuang, C., and Zhan, Z., "Study of the Design Representative Methods for the Optimization of Multi-layer Composite Structures", ASME 2017 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, IDETC2017-67309.
8. Chen, Z., Li, Y., Shao, Y., Huang, T., **Xu, H.**, Li, Y., Chen, W., Zeng, D., Avery, K., Kang, H. and Su, X., "A Comparative Study of Two RVE Modelling Methods for Chopped Carbon Fiber SMC", SAE Technical Paper, No. 2017-01-0224.
9. Zhao, X., Xi, Z., **Xu, H.** and Yang, R.J., "Model Bias Characterization Considering Discrete and Continuous Design Variables", ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, IDETC2016-60109.
10. **Xu, H.**, Chuang, C.H. and Yang, R.J., "Mixed-Variable Metamodeling Methods for Designing Multi-Material Structures", ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, IDETC2016-59176.
11. Li, Y., Chen, W., Jin, X., and **Xu, H. (Corresponding author)**, "3D Representative Volume Element Reconstruction of Fiber Composites via Orientation Tensor and Substructure Features", Proceedings of the American Society for Composites: Thirty-First Technical Conference. 2016.
12. **Xu, H.**, Chuang, C., and Yang, R., "Improving Multiobjective Multidisciplinary Optimization with a Data Mining-based Hybrid Method", ASME 2015 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC2015-47361.
13. **Xu, H.**, Liu, R., Choudhary, A. Chen, W., "A Machine Learning-based Design Representation Method for Designing Heterogeneous Microstructures", ASME 2014 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC2014-34570 (Best Paper Award).
14. **Xu, H.**, Majcher, M., Chuang, C., Fu, Y., Yang, R. J., "Comparative Benchmark Studies of Response Surface Model-based Optimization and Direct Multidisciplinary Design Optimization", SAE World Congress 2014.
15. **Xu, H.**, Li, Y., Brinson, L. C., Chen, W., "Descriptor-based Methodology for Designing Heterogeneous Materials System", ASME 2013 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC2013-12232.
16. **Xu, H.**, Greene, M. S., Deng, H., Brinson, L. C., Dikin, D., Chen, W., "Stochastic Reassembly for Managing the Information Complexity in Multilevel Analysis of Heterogeneous Materials", ASME 2012 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC2012-70668 (Best Paper Award).

PATENT APPLICATIONS

- **Xu, H.**, Friske, D.D., Selvasekar, S., Lee, E., Chuang, C.H. and Pfeiffer, J.J., “Article with solid, lattice, and hollow sub-regions.” U.S. Patent Application 15/879,852, filed July 25, 2019. US20190224910A1
- **Xu, H.**, Selvasekar, S., Chuang, C., and Lee, E., “Integrated digital thread for additive manufacturing design optimization of lightweight structures.” U.S. Patent Application 15/817,330, filed May 23, 2019. US20190152150A1.

INVITED TALKS

- “*Uncertainty Quantification Methods for the Computational Design of Microstructure-Structure Systems*”, Dassault Systemes Simulia Corporation, Jan 21, 2020
- “*Failure Model of Separators based on Statistical Analysis of Microstructures*”, 11th MIT workshop on Computational Modeling of Lithium-ion Batteries for Crash Safety, Nov 13, 2019
- “*Uncertainty Quantification Methods for Stochastic Microstructure Characterization and Reconstruction*”, Stony Brook University, Oct 25, 2019
- “*Computational Design and Uncertainty Quantification of Microstructure, Mesostructure, and Structure*”, Rutgers University, Jan 19, 2018
- “*Application of data mining methods in direct and RSM-based optimization*”, ESTECO Academy Workshop, Wayne State University, June 9, 2016

HONORS AND AWARDS

- Ford Defensive Publication Award, Dec. 2016
- Ford Defensive Publication Award, Jan. 2016
- JMD Editor’s Choice Paper Award for 2014, ASME - Journal of Mechanical Design (1 per year)
 - **Xu, H.**, Li, Y., Brinson, L. C., Chen, W., “*A Descriptor-based Design Methodology for Developing Heterogeneous Microstructural Materials System*”
- Best Paper Award, 40th ASME Design Automation Conference, Buffalo, NY, 2014 (1 out of 108)
 - **Xu, H.**, Liu, R., Choudhary, A. Chen, W., “*A Machine Learning-based Design Representation Method for Designing Heterogeneous Microstructures*”
- Terminal Year Fellowship, Northwestern University, 2013
- Best Paper Award, 38th ASME Design Automation Conference, Chicago, IL, 2012 (1 out of 124)
 - **Xu, H.**, Greene, M. S., Deng, H., Brinson, L. C., Dikin, D., Chen, W., “*Stochastic Reassembly for Managing the Information Complexity in Multilevel Analysis of Heterogeneous Materials*”
- Northwestern Predictive Science & Engineering Design Cluster Fellowship, 2011-2012
- Walter P. Murphy Fellowship, Mechanical Engineering, Northwestern University, 2010-2011
- Excellent University Graduate of LiaoNing Province, China, 2008 (top 1%)
- National Scholarship of China, Chinese Ministry of Education, 2006-2007

TEACHING

Lecturer: MEM3221 ME3295 Introduction to Products and Processes, University of Connecticut

- Developed the course from scratch
- Taught product development and manufacturing processes
- Built collaborative relations with local businesses at Connecticut and create “Junior Design” projects based on real-world product development needs
- Led “Junior Design” projects and mentored student teams working with local businesses

PUBLIC SERVICE HONORS & PROFESSIONAL REGISTRATIONS

- Editorial board, Editorial board, *CMC-Computers, Materials & Continua*
- ASME Design Automation Committee - Industry Liaison
- Session organizer and chair, SAE world congress
- Session organizer and chair, ASME Design Automation Conference (DAC)
- Session chair, World Congress of Structural and Multidisciplinary Optimization (WCSMO)
- Invited reviewer, The 13th International Conference on Structural Safety and Reliability (ICOSSAR2021), sponsored by the International Association for Structural Safety and Reliability (IASSAR)
- Invited reviewer of research proposals, European Research Council (ERC)
- Reviewer of nine international journals: *Journal of the Electrochemical Society*, *Structural and Multidisciplinary Optimization*, *Journal of Mechanical Design*, *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems*, *SAE International Journal*

of Materials and Manufacturing, Polymer International, Composite Structures, Journal of Composites Science and Advanced Materials Letters

- Member of American Society of Mechanical Engineers (ASME)
- Member of Society of Automotive Engineers (SAE)
- Member of International Society for Structural and Multidisciplinary Optimization (ISSMO)
- Co-chair, Ford Chinese Association Research & Advanced Engineering mentoring program