

XIAO LIANG, Ph.D.

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Department of Civil, Structural & Environmental Engineering
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BIOGRAPHY SKETCH

Dr. Xiao Liang is currently a Research Assistant Professor in the Department of Civil, Structural & Environmental Engineering at the University at Buffalo. His research focuses on health monitoring and autonomous inspection (e.g., using drones) through advanced data analytics, model-based and machine learning. He is particularly interested in such developments for infrastructure systems (especially the critical regional transportation infrastructures that are aging and usually beyond the initial design periods of use) and buildings to enable assessing and quantifying the condition of structures in near real-time, aiming to enhance their sustainability and resilience under service and extreme events. His research interests also include performance-based methodologies for hazard resilience, nonlinear structural dynamics, and earthquake engineering.

EDUCATION

University of California, Berkeley	2011 – 2016
<i>Ph.D. in Civil & Environmental Engineering</i>	
Major: Structural Engineering; Minors: Mechanics & Statistics	
Dissertation: <i>Performance-Based Robust Nonlinear Seismic Analysis with Application to Reinforced Concrete Bridge Systems</i>	
University of California, Berkeley	2010 – 2011
<i>M.S. in Civil & Environmental Engineering</i>	
Program: Structural Engineering, Mechanics and Materials	
Hunan University	2006 – 2010
<i>B.Eng. in Civil Engineering</i>	
Program: Structural Engineering	

APPOINTMENTS

Research Assistant Professor	09/2018 – present
Department of Civil, Structural & Environmental Engineering University at Buffalo, The State University of New York	
Research Scientist	01/2018 – 08/2018
Department of Civil, Structural & Environmental Engineering University at Buffalo, The State University of New York	
Postdoctoral Scholar	01/2017 – 01/2018
University of California, Berkeley Supervisor: Prof. Khalid M. Mosalam	

Co-Supervisor: Prof. Lin Zhang, Tsinghua-Berkeley Shenzhen Institute (TBSI)

Research Project: Developing Algorithms for Data-Driven Health Monitoring of Infrastructures Using Dense Array of Sensors

Graduate Student Researcher / Research Assistant

01/2012 – 12/2016

University of California, Berkeley

Supervisor: Prof. Khalid M. Mosalam

Research Topics:

- Seismic structural responses of reinforced concrete (RC) bridge systems
- Seismic fragility curves of RC bridge systems
- Robust & efficient performance-based nonlinear seismic analysis of structural systems
- Performance-based probabilistic evaluation of ground motion selection & modification procedures for RC bridge systems
- Development of Lyapunov-based nonlinear solution algorithm for structural analysis
- Analytical & numerical stability analysis of direct integration algorithms for multi-degree-of-freedom nonlinear structural systems via convex optimization

Research Intern Engineer

05/2011 – 08/2011

Pacific Earthquake Engineering Research (PEER) Center

University of California, Berkeley

Supervisor: Prof. Stephen A. Mahin & Prof. Yousef Bozorgnia

Research Project: Characterization of Small Magnitude Ground Motion (NGA-West2)

Research Specialist

10/2009 – 01/2010

University of California, Davis

Supervisor: Prof. Sashi K. Kunnath & Prof. Yan Xiao

Research Project: Modeling of Concrete Structures for Seismic Protection

AWARDS AND HONORS

- Registration Grant for 11NCEE, Earthquake Engineering Research Institute (EERI), 2018
- Best Poster Award, the Second TBSI Annual Meeting, China, 2017
- Liu Huixian Earthquake Engineering Scholarship Award, 2016
- ICCM Best Young Researcher Paper Award, 2016
- Graduate Division Conference Travel Grant, University of California, Berkeley, 2016, 2017
- Graduate Division Graduate Fellowship, University of California, Berkeley, 2011–2016

TEACHING EXPERIENCE

Engineering Statistics (CIE308)

Spring/Fall 2019

Department of Civil, Structural and Environmental Engineering

University at Buffalo, The State University of New York

Statistical Methods in Structural & Earthquake Engineering (CIE500)

Fall 2018

Department of Civil, Structural and Environmental Engineering

University at Buffalo, The State University of New York

Hybrid System Design for Smart City

Summer 2017

Tsinghua-Berkeley Shenzhen Institute

Role: Co-Instructor

Prestressed Concrete Structures

Spring 2012, 2015, & 2016

University of California, Berkeley

Role: Graduate Student Instructor

Instructor: Prof. Khalid M. Mosalam

Finite Element Methods

Spring 2015 & 2016

University of California, Berkeley

Role: Graduate Student Instructor

Instructor: Prof. Khalid M. Mosalam

Dynamics of Structures

Fall 2015

University of California, Berkeley

Role: Graduate Student Instructor

Instructor: Prof. Anil K. Chopra

RESEARCH SUPERVISION

Ph.D. Students

- Seyed Omid Sajedi, Department of Civil, Structural & Environmental Engineering, University at Buffalo (08/2017 – present, to be completed 05/2021)
- Kareem A. Eltouny, Department of Civil, Structural & Environmental Engineering, University at Buffalo (to be started in 08/2019)
- Zhu Chen (co-advised) Department of Mechanical & Aerospace Engineering, University at Buffalo (08/2018 – present, to be completed 05/2022)

M.S. Students

- Kareem A. Eltouny, Department of Civil, Structural & Environmental Engineering, University at Buffalo (04/2018 – 05/2019)
- Zarak Khan Kasi, Department of Civil, Structural & Environmental Engineering, University at Buffalo (05/2018 – present, to be completed 08/2019)

PUBLICATIONS

Google Scholar: <https://scholar.google.com/citations?user=I9PVM1YAAAAJ&hl=en>

ResearchGate: https://www.researchgate.net/profile/Xiao_Liang31

Journal Articles Submitted for Review (underlined: student at UB)

- [J1] **Liang, X.**, & Mosalam, K.M. Ground Motion Selection and Modification Evaluation on Highway Bridges under Bi-directional Excitation. *Submitted to Soil Dynamics & Earthquake Engineering*, May 2019.
- [J2] Wang, H., Zhang, Y., Sun, Y., Zhang, G., Tan, K., Su, M., Zheng, M., & **Liang, X.** Topology and Control Method of a Single-Cell Matrix-Type Solid State Transformer. *Submitted to IEEE Journal of Emerging & Selected Topics in Power Electronics*, April 2019.
- [J3] Zheng, M., Lyu, X., **Liang, X.**, & Zhang, F. A Generalized Design Method for Learning-Based Disturbance Observer. *Submitted to IEEE/ASME Transactions on Mechatronics*, April 2019.

- [J4] Lin, J., Su, M., Sun, Y., Xie, S., Feng, J., Zheng, M., & **Liang, X.** Impedance-Based Stability Analysis of Single-Phase Voltage Source Rectifier. *Submitted to IEEE Transactions on Power Electronics*, March 2019.
- [J5] Tang, Z., Yang, Y., Su, M., Jiang, T., Blaabjerg, F., Dan, H., & **Liang, X.** Modulation for the AVC-HERIC Inverter to Compensate Pulse Width Limitation. *Submitted to IEEE Transactions on Power Electronics*, March 2019.
- [J6] Sajedi, S. O., & **Liang, X.** Near Real-Time Semantic Damage Segmentation in Large-Scale SHM. *Submitted to Computer-Aided Civil & Infrastructure Engineering*, March 2019.
- [J7] Liu, Z., Su, M., Sun, Y., Zhang, X., **Liang, X.**, & Zheng, M. A Comprehensive Study on Existence and Stability of Equilibria of DC Distribution with Constant Power Loads. *Submitted to IEEE Transactions on Automatic Control*, January 2019.
- [J8] Sajedi, S. O., & **Liang, X.** A Data-Driven Framework for Near-Real Time and Robust Damage Diagnosis of Building Structures. *Submitted to Structural Control & Health Monitoring*, December 2018.
- [J9] **Liang, X.**, & Mosalam, K.M. Seismic Damage Detection and Assessment for Highway Bridge Systems Using Pattern Recognition with Bayesian Optimization. *Submitted to Journal of Sound & Vibration*, May 2018.

Journal Articles Published

- [J10] **Liang, X.** (2019). Image-Based Post-Disaster Inspection of Reinforced Concrete Bridge Systems Using Deep Learning with Bayesian Optimization. *Computer-Aided Civil & Infrastructure Engineering*, 34(5), 415-430.
- [J11] Liu, Y., Su, M., Liu, F., Sun, Y., Zheng, M., **Liang, X.**, Xu, G., & Sun, Y (2019). Single-Phase Inverter with Wide Input Voltage and Power Decoupling Capability. *IEEE Access*, 7, 16970-16879.
- [J12] Cheng, L., Zuo, Z., Song, J., & **Liang, X.** (2019). Robust Three-Dimensional Path-Following Control for an Under-Actuated Stratospheric Airship. *Advances in Space Research*, 63(1), 526-538.
- [J13] **Liang X.**, M. Zheng, M., & Zhang, F. (2018). A Scalable Model-Based Learning Algorithm with Application to UAVs. *IEEE Control Systems Letters*, 2(4), 839-844.
- [J14] Zheng, M., Zhang, F., & **Liang, X.** (2018). A Systematic Design Framework for Iterative Learning Control with Current Feedback. *IFAC Journal of Systems & Control*, 5, 1-10.
- [J15] **Liang, X.**, & Mosalam, K.M. (2018). Lyapunov-Based Nonlinear Solution Algorithm for Structural Analysis. *Journal of Engineering Mechanics*, 144(9), 04018082.
- [J16] **Liang, X.**, & Mosalam, K.M. (2016). Lyapunov Stability Analysis of Explicit Direct Integration Algorithms Applied to Multi-Degree-of-Freedom Nonlinear Dynamic Problems. *Journal of Engineering Mechanics*, 142(12), 04016098.
- [J17] **Liang, X.**, & Mosalam, K.M. (2016). Lyapunov Stability Analysis of Explicit Direct Integration Algorithms Considering Strictly Positive Real Lemma. *Journal of Engineering Mechanics*, 142(10), 04016079.
- [J18] **Liang, X.**, Mosalam, K.M., & Günay, S. (2016). Direct Integration Algorithms for Efficient Nonlinear Seismic Response of Reinforced Concrete Highway Bridges. *Journal of Bridge Engineering*, 21(7), 04016041.
- [J19] **Liang, X.**, & Mosalam, K.M. (2016). Lyapunov Stability and Accuracy of Direct Integration Algorithms Applied to Nonlinear Dynamic Problems. *Journal of Engineering Mechanics*, 142(5), 04016022.

- [J20] Shu, X., Liu, X., Lu, B., & **Liang, X.** (2009). Research on the Seismic Performance of Steel Frame-Concrete Core Tube Structures with Eccentric Braces. *Journal of Hunan University (Natural Sciences)*, 36(8), 7–11.

Conference Proceedings

- [C1] **Sajedi, S. O.**, & **Liang, X.** Intensity-Based Feature Selection for Near Real-Time Damage Diagnosis of Building Structures. *Submitted to 2019 IABSE Congress*, May 2019.
- [C2] Zheng, M., **Chen, Z.**, & **Liang, X.** A Preliminary Study on A Physical Model Oriented Learning Algorithm with Application to UAVs. *Submitted to Dynamics System and Control Conference*, April 2019.
- [C3] **Sajedi, S. O.**, & **Liang, X.** (2019). A Convolutional Cost-Sensitive Crack Localization Algorithm for Automated and Reliable RC Bridge Inspection. *10th New York City Bridge Conference*, New York City, NY, August 26-27.
- [C4] **Liang, X.**, & Zheng, M. (2019). Estimation of Rail Vertical Profile Using an H-Infinity Based Observer with Learning. In *2019 Joint Rail Conference*, American Society of Mechanical Engineers.
- [C5] **Liang, X.**, Mosalam, K.M., & Muin, S. (2018). Simulation-Based Data-Driven Damage Detection for Highway Bridge Systems. *11th National Conference on Earthquake Engineering (11NCEE)*, Los Angeles, CA, June 25-29.
- [C6] **Liang, X.**, & Mosalam, K.M. (2018). Development of a Robust Nonlinear Solution Algorithm for Structural Analysis. *11th National Conference on Earthquake Engineering (11NCEE)*, Los Angeles, CA, June 25-29.
- [C7] **Liang, X.**, & Mosalam, K.M. (2017). Evaluation of Ground Motion Selection and Modification Methods on Reinforced Concrete Highway Bridges. *16th World Conference on Earthquake Engineering (16WCEE)*, Santiago, Chile, January 9-13.
- [C8] **Liang, X.**, & Mosalam, K.M. (2016). Stability Investigation of Direct Integration Algorithms Using Lyapunov-Based Approaches. *7th International Conference on Computational Methods (ICCM 2016)*, Berkeley, CA, August 1-4 (**Best Paper Award**).
- [C9] **Liang, X.**, Günay, S., & Mosalam, K.M. (2014). Integrators for Nonlinear Response History Analysis: Revisited. *Istanbul Bridge Conference*, Istanbul, Turkey, August 11-13.
- [C10] Mosalam, K.M., **Liang, X.**, Günay, S., & Schellenberg, A. (2013). Alternative Integrators and Parallel Computing for Efficient Nonlinear Response History Analyses. *4th International Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN 2013)*, Kos Island, Greece, June 12-14.

Book Chapters

- [B1] **Liang, X.**, Günay, S., & Mosalam, K.M. (2016). *Chapter 12: Seismic Response of Bridges Considering Different Ground Motion Selection Methods*, in *Developments in International Bridge Engineering*, Springer Tracts on Transportation and Traffic 9, Springer Int. Publishing, Switzerland.

Technical Reports

- [T1] **Liang, X.**, & Mosalam, K.M. (2016). *Performance-Based Robust Nonlinear Seismic Analysis with Application to Reinforced Concrete Highway Bridge Systems*. Pacific Earthquake Engineering Research Center, PEER report 2016/10, University of California, Berkeley, CA.

- [T2] Omrani, R., Mobasher, B., **Liang, X.**, Günay, S., Mosalam, K.M., Zareian, F., & Taciroglu, E. (2015). *Guidelines for Nonlinear Seismic Analysis of Ordinary Bridges: Version 2.0*. CA 15-2266, California Department of Transportation, Sacramento, CA.
- [T3] **Liang, X.**, & Mosalam, K.M. (2015). *Lyapunov Stability and Accuracy of Direct Integration Algorithms in Nonlinear Dynamic Problems and Considering the Strictly Positive Real Lemma*. SEMM Technical Report UCB/SEMM-2015/01, University of California, Berkeley, CA.

Posters

- [P1] Sajedi, S. O., & **Liang, X.** (2019). *Image-Based Bridge Inspection Using Bayesian Optimized Deep Convolutional Neural Networks*, 2019 Transportation Research Board Annual Meeting, UB reception, Washington, DC.
- [P2] **Liang, X.**, & Mosalam, K.M. (2017). *Simulation-Based Data-Driven Damage Detection for Highway Bridge Systems*, 2017 TBSI Year-End Poster Session, Berkeley, CA.
- [P3] **Liang, X.**, Muin, S., & Mosalam, K.M. (2017). *Robust Simulation-based Data-Driven Structural Health Monitoring for Highway Bridge Systems*, 2017 TBSI Annual Meeting, China (**Best Poster Award**).

SELECTED PRESENTATIONS

- 04/2019** Artificial Intelligence in Vibration-Based Structural Health Monitoring and Bridge Inspection. Bridge Practice Webinar, Michael Baker International.
- 04/2019** Estimation of Rail Vertical Profile Using an H-Infinity Based Observer with Learning. 2019 ASME Joint Rail Conference, Snowbird, UT.
- 06/2018** Development of A Robust Nonlinear Solution Algorithm for Structural Analysis. 11th National Conference on Earthquake Engineering, Los Angeles, CA.
- 11/2017** Simulation-Based Data-Driven Damage Detection for Highway Bridge Systems. Structural Engineering, Mechanics and Materials Seminar, Department of Civil & Environmental Engineering, University of California, Berkeley.
- 03/2017** Performance-Based Robust Nonlinear Seismic Analysis with Application to Reinforced Concrete Bridge Systems, Civil, Structural & Environmental Engineering Seminar, University at Buffalo, NY.
- 02/2017** Lyapunov-based Robust Nonlinear Time History Analysis, eCal Seminar. University of California, Berkeley, CA.
- 08/2016** Stability Investigation of Direct Integration Algorithms Using Lyapunov-Based Approaches. 7th International Conference on Computational Methods, Berkeley, CA.
- 06/2013** Alternative Integrators and Parallel Computing for Efficient Nonlinear Response History Analyses. Hunan University, Changsha, Hunan, China.

PROFESSIONAL SERVICE

Journal Reviewer

- Journal of Engineering Mechanics
- Engineering Computations
- Engineering Structures

- Science China Physics, Mechanics & Astronomy
- Computer-Aided Civil & Infrastructure Engineering
- Soil Dynamics & Earthquake Engineering
- IEEE Components, Packaging & Manufacturing Technology

Conference Service & Reviewer

- 11th National Conference on Earthquake Engineering
- 2018 International Conference on Control, Automation, Robotics and Vision
- 2019 American Control Conference
- 2019 Joint Rail Conference
- 10th New York City Bridge Conference
- Co-Chair of the Special Session “Advances in Bridge Modeling and Nonlinear Time History Analysis,”
11th National Conference on Earthquake Engineering

University Service

- Member, Ph.D. Committee of Nidhish Jain, University at Buffalo
- Member, Ph.D. Committee of Zhu Chen, University at Buffalo
- Chair, M.S. Committee of Kareem A. Eltouny, University at Buffalo
- Chair, M.S. Committee of Zarak Khan Kasi, University at Buffalo
- Faculty Judge for the Annual CSEE Poster Competition, Spring 2018 & 2019

Professional Society Memberships

- American Society of Civil Engineers
- Earthquake Engineering Research Institute
- Technical Committee on Vibration, Dynamic Systems and Control Division, American Society of Mechanical Engineers