XINGQUAN GUAN

CONTACT INFORMATION

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WORK EXPERIENCE

Postdoctoral Fellow at University of California, Los Angeles — Mar. 2021 ~ Present
Supervisor: Prof. Henry Burton and Prof. Yousef Bozorgnia
Projects: [1] Seismic risk analysis of distributed lifeline systems using high performance computing
[2] Collaborative-filtering-based building seismic response prediction

University of California, Los Angeles (UCLA)

- Ph.D. in Structural and Earthquake Engineering — Mar. 2021
  Dissertation: *Performance-based analytics-driven seismic design of steel moment frame buildings*
  Research Advisor: Prof. Henry Burton
  Doctoral Committee: Prof. John Wallace, Prof. Thomas Sabol, Prof. Ertugrul Taciroglu, Prof. Jingyi Li
- M.Sc. in Civil Engineering — Dec. 2020
- Minor in Statistics (10 graduate-level courses in Statistics and 4 in Computer Science)

Huazhong University of Science and Technology (HUST)

- M.Sc. in Structural Engineering — June 2016
  Thesis: Ultimate capacity and cyclic behavior of tubular structures after fire exposure
  Research Advisor: Prof. Fei Gao and Prof. Hongping Zhu
- B.Sc. in Civil Engineering — June 2013

RESEARCH INTERESTS

- Physics-based simulation and artificial intelligence in enhancing community resilience
- Multi-hazard risk and uncertainty quantification of distributed infrastructures
- Full-scale experimental testing and finite element modeling from the component to the structural level
- Performance-based design and assessment approach development

RESEARCH EXPERIENCE

Seismic risk assessment of gas/water pipeline system — May 2021 – Present
Postdoctoral Fellow, UCLA — Advisor: Yousef Bozorgnia

- Established an automated platform to construct the macro finite element model for the natural gas pipeline system in southern California and evaluated the seismic response subjected to the ground motion with spatial variability.
- Quantified the effect of various parameters (e.g., pipe configurations, soil properties, and distance to fault) on the pipe performance.

Building collapse capacity evaluation using recommender system — May 2021 – Present
Postdoctoral Fellow, UCLA — Advisor: Henry Burton

- Formulated the relationship between the machine learning model complexity and associated generalizability.

- Devised a novel collaborative filtering algorithm based incremental dynamic analysis to evaluate the collapse capacity, which improved the efficiency by 50%.

Performance-based analytics-driven design for SMRFs Mar. 2018 – Mar. 2021

Graduate Researcher, UCLA Advisor: Henry Burton

- Developed a Python-based computational platform to automate seismic design, nonlinear model construction, structural response simulation, and economic loss assessment, which reduced the design completion time from weeks to minutes. This platform has been delivered to Natural Hazards Engineering Research Infrastructure SimCenter.
- Created a database that includes 621 steel moment resisting frame (SMRF) designs, corresponding nonlinear structural models, and seismic responses for these buildings subjected 240 earthquake ground motions.
- Applied machine models (e.g., linear regression, random forest, XGBoost, and artificial neural network) to estimate building responses under earthquakes and tested them against 149,040 scenarios.
- Assessed the performance of purely mechanic-based, hybrid, and data-driven models in estimating structural deformation under earthquakes.
- Proposed surrogate models to predict the distribution of engineering demand parameters and verified the models based on the earthquake-induced economic losses.

Seismic performance of self-centering SMF buildings June 2017 ~ Mar. 2018

Graduate Researcher, UCLA Advisor: Henry Burton; Saber Moradi

- Developed a phenomenological model to capture the cyclic behavior of post-tensioned connections.
- Constructed the nonlinear models for self-centering moment resisting frames (MRFs) using post-tensioned connections and conventional MRFs.
- Performed the seismic response simulation and assessed the economic loss for buildings using conventional or self-centering MRFs.

Fire resistance behavior of steel tubular structures Sept. 2013 – June 2016

Research Assistant, HUST Advisor: Fei Gao; Hongping Zhu

- Conducted five full-scale experimental tests to investigate the ultimate strength, cyclic behavior, and fatigue behavior of steel tubular joints prior to, during, and after fire exposures.
- Developed a finite element framework that could simulate the response of steel joints during an entire fire process by using secondary development in ABAQUS.
- Derived empirical equations to estimate the critical temperature of tubular joints subjected to fire.

JOURNAL PUBLICATIONS (*corresponding author)

[1] **Guan, X.*** & Burton, H. (2022). Recommender system-inspired building collapse performance evaluation. Computer-Aided Civil and Infrastructure Engineering. (Ready to Submit).

[2] **Guan, X.*** & Burton, H. (2022). Bias-variance tradeoff in machine learning: theoretical formulation and implications to structural engineering applications. Journal of Structural Engineering. (Under review).

[3] Zeng, Z., Zhu, Z., Yao, W., Wang, Z., Wang, C., Wei, Y.*, Wei, Z., & **Guan, X.** (2022). Accurate prediction of concrete compressive strength based on explainable features using deep learning. Construction and Building Materials. (Under review).

[4] **Guan, X.***, Burton, H., Shokrabadi, M., & Yi, Z. (2021). Seismic drift demand estimation for steel moment frame buildings: from mechanics-Based to data-driven models. Journal of Structural Engineering, 147(6), 04021058.

[5] Gao, F., Liu, Z., & **Guan, X.*** (2021). Fire resistance behavior of T-stub joint components under transient heat transfer conditions. Engineering Structure, 237, 112164.

[6] **Guan, X.**, Burton H., & Shokrabadi, M. (2021). A database of seismic designs, nonlinear models, and seismic responses for steel moment-resisting frame buildings. Earthquake Spectra, 37(2), 1199-1222.
[7] **Guan, X.**, Burton, H., & Sabol, T. (2020). Python-based computational platform to automate seismic design, nonlinear structural model construction and analysis of steel moment resisting frames. Engineering Structures, 224, 111199.
[8] Gao, F., Xiao, Z., **Guan, X.***, Zhu, H., & Du, G. (2019). Dynamic behavior of CHS-SHS tubular T-joints subjected to low-velocity impact loading. Engineering Structures, 183, 720-740.
[9] **Guan, X.**, Burton, H., & Moradi, S. (2018). Seismic performance of a self-centering steel moment frame building: from component-level modeling to economic loss assessment. Journal of Constructional Steel Research, 150, 129-140.
[10] Gao, F., Tang, Z., **Guan, X.***, Zhu, H., & Chen, Z. (2018). Ultimate strength of tubular T-joints reinforced with doubler plates after fire exposure. Thin-Walled Structures, 132, 616-628.
Gao, F., **Guan, X.***, Zhu, H., & Ye, Y. (2018). Fire-resistance behavior of completely overlapped tubular joints under lap brace axial loading. Journal of Structural Engineering, 144(9), 04018137.
[11] Mohamed, H.S.*, Gao, F., **Guan, X.**, & Zhu, H. (2018). Experimental investigation on the fatigue behavior of heat-treated tubular T-joints. KSCE Journal of Civil Engineering, 22, 2451-2463.
[12] Gao, F., **Guo, X.***, Long, X., Guan, X., & Zhu, H. P. (2018). Hysteretic behavior of SHS brace-H-shaped chord T-joints with transverse stiffeners. Thin-Walled Structures, 122, 387-402.
[13] Gao, F.*, **Guan, X.**, Zhu, H., & Liu, X. (2015). Fire resistance behavior of tubular T-joints reinforced with collar plates. Journal of Constructional Steel Research, 115, 106-120.
[14] Gao, F.*, **Guan, X.**, Zhu, H., & Xia, Y. (2015). Hysteretic behavior of tubular T-joints reinforced with doubler plates after fire exposure. Thin-Walled Structures, 92, 10-20.

CONFERENCE PRESENTATIONS

[1] **Guan, X.** & Burton, H. A comparative assessment of mechanistic and data-driven models to estimate building responses. 17 World Conference on Earthquake Engineering, Sendai, Japan, September 2021.
[2] **Guan, X.** & Burton, H. A Python-based platform to automate seismic design and nonlinear analysis of steel moment frames. 17th World Conference on Earthquake Engineering, Sendai, Japan, September 2021.
[3] Burton, H. & **Guan, X.** The case for incorporating artificial intelligence and automation in performance-based seismic design. 2020 SEAOC Convention. Maui, U.S.A., December 2020.
[4] **Guan, X.**, Moradi, S., & Burton, H. Seismic performance of a self-centering steel moment frame building. 11th U.S. National Conference on Earthquake Engineering, Los Angeles, U.S.A., June 2018.
[5] Gao, F., **Guan, X.** & Zhu, H. Parametric study on hysteretic behavior of doubler plate-reinforced tubular T-joints after fire exposure. 13th International Symposium on Structural Engineering. Hefei, China, October 2014.

TEACHING AND MENTORING EXPERIENCE

Teaching Fellow, UCLA

Course: Advanced Steel Structures	Spring 2019
Teaching evaluation: 8.9/9.0 and 8.8/9.0	Spring 2020

Teaching Associate, UCLA

Course: Advanced Structural Analysis	Fall 2018
Teaching evaluation: 8.8/9.0 and 8.0/9.0	Fall 2019

Teaching Assistant, UCLA

Course: Structural System Design (Teaching evaluation: 8.3/9.0) Spring 2018

Research Mentor, HUST

HUST Undergraduate Research Program 2014 – 2015

SELECTED FELLOWSHIPS, HONORS AND AWARDS

12th National Conference on Earthquake Engineering Grant 2022

Graduate Division Fellowship, UCLA 2018, 2019, 2020

Doctoral Student Travel Grant, UCLA 2020

National Scholarship, Awarded by Ministry of Education of China 2015

REFERENCES

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