XINGQUAN GUAN

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WORK EXPERIENCE

Senior Data Scientist
ZEST AI (Burbank, CA, USA) Mar. 2022 ~ Present

- Helped to create an end-to-end Python platform that fully automates the process of data preprocessing, XGBoost model construction, and data interpretation, which delivers a 500% efficiency boost in the modeling stage.
- Leveraged AI-based explainable algorithms to promote equity, fairness, and transparency in the decision-making process of underwriting services.

Postdoctoral Fellow
University of California, Los Angeles May 2021 ~ Apr. 2022
Supervisors: Prof. Henry Burton and Prof. Yousef Bozorgnia

- Probabilistic risk assessment of gas pipeline systems in Southern California.
- Recommender system-inspired collapse fragility assessment in steel structures.

EDUCATION

University of California, Los Angeles (UCLA)

Ph.D. in Structural and Earthquake Engineering Mar. 2021
Minor in Statistics and Computer Science
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

Huazhong University of Science and Technology (HUST)

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

RESEARCH INTERESTS

- Multi-hazard risk and resilience assessment of infrastructural systems
- Causal inference and artificial intelligence incorporation in decision support systems
- Full-scale structural testing and high-fidelity modeling of structures under extreme loading
- Performance-based design and assessment approaches
- AI-based structural seismic design and analysis automation

RESEARCH SOFTWARE DEVELOPMENT & PUBLISHING

Automated Seismic Design and Analysis (AutoSDA) Platform

- The platform has been adopted as a part of *NSF NHERI (Natural Hazards Engineering Research Infrastructure) EE-UQ (Earthquake Engineering with Uncertainty Quantification)* framework.
- The platform has been commercially used in three projects: (1) seismic design of Taylor damped moment frame (TDMF) partnered with *SP3*, (2) cost benefit analysis of TDMF partnered with *Englekirk*, and (3) cost benefit analysis to support functional recovery initiative launched by *NIST (National Institute of Standard Technology)*.

JOURNAL PUBLICATIONS (*corresponding author)

[1] Chen, P-Y & **Guan, X.*** (2023). A multi-source data-driven approach for evaluating the seismic response of non-ductile concrete moment frames. *Engineering Structures,* 278, 115452

[2] **Guan, X.*** & Burton, H. (2022). Bias-variance tradeoff in machine learning: theoretical formulation and implications to structural engineering applications. *Structures,* 46, 17-30

[3] Zeng, Z., Zhu, Z., Yao, W., Wang, Z., Wang, C., Wei, Y., ... & **Guan, X.** (2022). Accurate prediction of concrete compressive strength based on explainable features using deep learning. *Construction and Building Materials*, 329, 127082

[4] **Guan, X.***, Burton, H., Shokrabadi, M., & Yi, Z. (2021). Seismic drift demand estimation for SMF buildings: from mechanistic 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. (2020). A database of seismic designs, nonlinear models, and seismic responses for steel moment resisting frame buildings. *Earthquake Spectra.* 8755293020971209.

[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.

[11] 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.

[12] 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.

[13] 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.

[14] 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.

[15] 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. Collaborative Filtering-Based Collapse Fragility Assessment. 12th National Conference on Earthquake Engineering, Salt Lake City, USA, June, 2022.
[2] **Guan, X.** & Burton, H. A comparative assessment of mechanistic and data-driven models to estimate building responses. *17th World Conference on Earthquake Engineering*, Sendai, Japan, September 2020.
[3] **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 2020.
[4] 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.
[5] **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.
[6] 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.

RESEARCH EXPERIENCE

Explainable AI-based structural performance evaluation Mar. 2021 ~ Present
Independent Researcher

- Developed a multi-source data-driven approach that leverages well-structured and unstructured data to estimate the seismic demands in non-ductile buildings.
- Adapted the long short-term memory (LSTM) network to predict the floor acceleration response spectrum.

Seismic risk assessment of gas pipeline system May 2021 ~ Mar. 2021
Postdoctoral Fellow, UCLA Advisor: Yousef Bozorgnia

- Established an automated platform for constructing 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.

Recommender system-inspired collapse capacity evaluation May 2021 ~ Mar. 2021
Postdoctoral Fellow, UCLA Advisor: Henry Burton

- Formulated a generic relationship between the machine learning-based model complexity and the associated generalizability.
- Devised a novel collaborative filtering-based collapse capacity assessment approach, 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.
- 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 statistical 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

- 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

- 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 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.

PATENTS

Gao, F., **Guan X.,** et al. A new gauge for measuring the displacement. China, No. 201520076748.X.

SELECTED FELLOWSHIPS, HONORS AND AWARDS

12NCEE CSI Travel Award	2022
Graduate Division Fellowship, UCLA	2018, 2019, 2020
Doctoral Student Travel Grant, UCLA	2020
National Scholarship, Awarded by Ministry of Education of China	2015

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