Ph.D. Candidate

Department of Civil and Environmental Engineering
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LAO YEJUN

EDUCATION:

University of Michigan

- **Ph.D. in Civil Engineering**   Advisor: Prof. Jeffery T. Scruggs   Sept. 2017 – Sept. 2020 (expected)
  - Research Topic: *Robust Control of Wave Energy Converters with Finite Stroke*
- **M.S. in Electric & Computer Engineering**   Sept. 2018 – April 2020
  - Main Courses: Linear Systems, Linear Feedback Control, Stochastic Control, Stochastic Control, Nonlinear System and Control, Continuous Optimization Methods, Machine Learning, Information Retrieval, Matrix Method of Signal Processing, Foundation of Computer Vision
  - GPA: 3.95/4.0
- **M.S. in Civil Engineering**   Sept. 2015 – May. 2017
  - Main Courses: Stochastic Systems, Dynamics of Structures, Dynamics Infrastructure System, Infrastructure sensing
  - GPA: 4.0/4.0

Tongji University

- **Bachelor of Engineering in Civil Engineering**   Sept. 2011 – June. 2015
  - Thesis: *Series Compensation Platform Seismic Performance Analysis*
  - GPA: 4.46/5.0 (equivalent to 89.61/100)

RESEARCH EXPERIENCES:

Department of Civil and Environmental Engineering, University of Michigan

Graduate Student Research Assistant   Advisor: Prof. Jeffery T. Scruggs

- **Robust Control of Wave Energy Converters**   May 2019 – Present
  - Optimized the nominal performance for a Wave Energy Converters in a stochastic waves, subject to the constraint that the controller be stability-robust to unstructured uncertainties.
  - Due to the nonconvexity of the problem, proposed an iterative algorithm, called Iterative Convex Overbounding, to be used to arrive at a local optimal solution.
- **Casual Control Design of Wave Energy Converters with Finite Stroke**   June 2017 – May 2019
  - Designed a linear feedback control law to maximize power generation, without considering the actuation stroke limits.
  - Illustrated a technqiue whereby a linear feedback law can be augmented with a outer nonlinear feedback loop which protects against stroke saturation while simultaneously maintaining close-loop stability.
  - Expaneded this technique to discrete-time controller.
- **Spectral Factorization of Infinite Dimensional Systems**   June 2016 – Dec. 2017
  - Proposeed a new robust subspace based spectral factorization algorithm to produce a valid approximate finite-dimensional state space model.

- ○ Illustrated that new algorithm works more efficiently than the previous by applying both algorithm to factor the velocity spectrum for an array of floating cylindrical buoys.
- **Damage Detection in Reinforced Concrete Frame**   Jan. 2016 – May 2016
  - ○ Utilized spectral analysis, residual deformation and component energy distribution to identify structural nonlinearity.
  - ○ Evaluated the overall structural damage condition by Park-Ang Damage Index, and used the relationship between element height and lateral deformation to reveal where the damage is.

College of Civil Engineering, Tongji University

Undergraduate Research Assistant   Advisor: Prof. Qiang Xie

- **Filter Capacitor Seismic Performance Analysis**   May 2015 – Aug. 2015
  - ○ Simulated filter capacitor and its sustained steel frame in ABAQUS to do the analysis of an entire structure.
  - ○ Checked the tension insulator axial force and middle structure displacement under earthquake loading.
- **Series Compensation Platform Seismic Performance Analysis**   Sept. 2014 – June 2015
  - ○ Based on post insulator eccentric compression test, obtained insulator's basic mechanical properties.
  - ○ In dynamic analysis, through the comparison with the responses under different seismic waves, proposed the damage-prone part in the Series Compensation Platform.

RESEARCH PUBLICATIONS:

Journal Articles

1. **Lao, Y.,** and Scruggs, J. T., (2020). "Nonlinear Control of Passive Vibratory Networks with Finite Actuation Stroke." *Automatica*, 118, 109013

Journal Articles (In Preparation)

1. **Lao, Y.,** and Scruggs, J. T., (2020). "Discete-time Nonlinear Casual Control of Wave Energy Converters with Finite Stroke."

Peer Reviewed Conference Proceedings

1. **Lao, Y.,** and Scruggs, J.T., (2020). "Robust Control of Wave Energy Converters Using Unstructured Uncertainty." *2020 American Control Conference (ACC)*. Denver, USA.

2. **Lao, Y.,** and Scruggs, J.T., (2019). "A Modified Technique for Spectral Factorization of Infinite-Dimensional Systems Using Subspace Techniques." *2019 IEEE 58th Conference on Decision and Control (CDC)* (pp5412-5419). Nice, France.

3. Scruggs, J. T., and **Lao, Y.,** (2019). "Discrete-time causal control of WECs with finite stroke, in stochastic waves." *2019 European Wave and Tidal Energy Conference (EWTEC)*. Napoli, Italy.

4. Scruggs, J. T., and **Lao, Y.,** (2019). "A new passivity-based nonlinear causal control technique for wave energy converters with finite stroke." *2019 American Control Conference (ACC)* (pp5472–5479). Philadelphia, USA.

INVITED RESEARCH PRESENTATIONS:

Invited Conference Presentations

1. "Robust Control of Wave Energy Converters Using Unstructured Uncertainty." American Control Conference, July 1-3, 2020, Denver, USA

2. "A new passivity-based nonlinear causal control technique for wave energy converters with finite stroke." American Control Conference, July 10-12, 2019, Philadelphia, USA

AWARDS AND SCHOLARSHIPS:

- Student Travel Award, American Control Conference, 2020
- Rackham Conference Travel Grant, University of Michigan, 2019
- Scholarship for Outstanding Undergraduate Students, Tongji, 2012 - 2014
- National Scholarship, Tongji, 2012

TEACHING EXPERIENCE:

At the University of Michigan

- CEE 265 Sustainable Engineering Principle (120 students), Graduate Student Instructor, Jan.2020 - April 2020
- CEE 373 Statistical Methods for Data Analysis and Uncertainty Modeling (72 students), Graduate Student Instructor, Sept. 2018 - Dec. 2018

PROFESSIONAL SERVICE:

- Reviewer, Mechatronics
- Reviewer, American Control Conference
- Studeent Member, American Society of Civil Engineers (ASCE), 2016 – Present.
- Volunteer, Discover Engineering Program, University of Michigan, 2018
- Student Mentor, University of Michigan.