

Tso-Kang Wang

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Objective & Summary of Qualifications

Self-motivated doctorate student with solid understanding of aerodynamics, nonlinear dynamics and optimization theories backed by a record of academic and professional success. Aiming to transform knowledge into products with innovative problem-solving skill and team-based mindset.

- Strong CFD background in aerodynamics, nonlinear dynamics, and flow control
- Expertise in analyzing and modeling of complex and transient flow with modal analysis techniques
- Experiences utilizing optimization techniques to improve hardware design
- Multidisciplinary experiences including hands-on experimental works and mass production
- Outstanding communication skills proved through publications, presentations, and leadership roles

Technical Skills

- **Research topics:** Fluid-structure interaction (FSI), Computational fluid dynamics (CFD), Active flow control, Structural health monitoring (SHM), Bio-inspired Robotics, Modal analysis, Reduced order modeling, Finite element modeling, High performance computing, Nonlinear dynamics, Optimization
- **Programming & Software:** MATLAB, Fortran, Python, LabVIEW, SOLIDWORKS, VisIt, Ansys Fluent
- **Miscellaneous:** \LaTeX , Slurm, MS Word, MS PowerPoint

Professional Experience

Graduate Research Assistant

FAMU-FSU College of Engineering

08/2017 – Present

Tallahassee, United States

- Modeling and controlling fluid-structure interaction systems involving compliant surfaces
1. Active flow control with morphing surfaces
 - Developed a fully-coupled fluid-structure interaction Fortran algorithm which can simulate flow around a smoothly morphing body utilizing conformal mapping techniques.
 - Investigated the aeroelastic characteristic of a foil with an active flap using linear stability analysis, return maps and Lyapunov exponents.
 - Developed a multiscale geometrically weighted modal analysis method which can be applied to any smoothly deforming geometry.
 - Designing a model predictive control scheme for regulating the aeroelastic response of an airfoil with actively morphing surface (in progress).
 2. Modal analysis for transient responses
 - Extended the Python-based 1-D kernel mode decomposition to spatial analysis.
 - The kernel-based sparsification network successfully tracked the amplitude and location of varied-frequency signals with k-means clustering in the formation process of a separation bubble.
 3. Flow-informed structural health monitoring
 - Developed a structural health monitoring technique with the fluidic forcing as input, which can be performed on the fly without the need of scheduled maintenance.
 - Modeled a damaged compliant plate under environmental influence with a Fortran FEM algorithm.
 - Performed eigenvalue realization algorithm with fluidic forcing and measured panel vibration to reconstruct a state-space model, then successfully identified the damage extent using genetic algorithm global optimization scheme (Dakota toolkit).
 - Designing a procedure to infer flow state from structural measurement with resolvent analysis (in progress).
 4. Peripheral leakage patterns of facemasks
 - Correlated face mask leakage and facial features systematically with 3D morphable face models.
 - Deployed mask as a FEM fabric to geometrically weighted PCA modified Basel face model database.

Hardware Engineer & Operations Manager

FLUX Inc.

11/2014 – 07/2016

Taipei City, Taiwan

- Managed the Kickstarter campaign that raised over USD \$1.6 million for the modular 3D printer, FLUX Delta.
- Cooperated with KENTEC Inc. for mass production and fulfilled all pre-order units by end of 2016.

- Designed the first iteration of the multi-functional holder module which can switch between laser engraving, vinyl cutting and drawing toolheads with SOLIDWORKS.
- Led the customer communication and support team which delivered bi-weekly communication newsletters, provided technical support, and managed Zendesk help center.
- FLUX Delta claimed 2016 CES Innovation Awards, 2016 Red Dot Design Award and 2016 iF Gold Award.

Graduate Research/Teaching Assistant

09/2014 – 06/2016

National Taiwan University

Taipei City, Taiwan

- Expanded a reduced-order model to include energy input and dissipation and terrain interactions for enabling fast traversing of an insect-inspired hexapod robot under unknown ground conditions.
- Utilized nonlinear optimization techniques to determine the stable criteria of the model in MATLAB.
- Developed a hybrid position-force control scheme with LabVIEW for enabling steady robot running motion.
- Designed experimental apparatus with Vicon motion capture system for 3D robot posture tracking.
- Drafted quiz and lecture slides and delivered lectures for Automatic Control course.

Education

Ph.D. in Mechanical Engineering

08/2017 – Fall 2022 (anticipated)

Florida State University, overall GPA: 3.9/4.0

Tallahassee, United States

M.S. in Mechanical Engineering

09/2014 – 06/2016

National Taiwan University, overall GPA: 4.1/4.3

Taipei City, Taiwan

B.S. in Physics

National Taiwan University

09/2010 – 06/2014

Taipei City, Taiwan

- Relevant Coursework: Mechanics, Electronics, Nonlinear dynamics

Volunteering and Leadership Experience

Co-Chair and Co-Founder

09/2019 – 05/2022

ME Graduate Student Association, FAMU-FSU College of Engineering

Tallahassee, United States

- Co-founded the first graduate student association in the college of engineering.
- Cooperated with Challenger Learning Center and local high school to communicate with the public about the importance of supporting technological development.

President

08/2012 – 07/2013

Students' Society of Department of Physics, National Taiwan University

Taipei City, Taiwan

Publications and Presentations (details available on Google Scholar)

Journal Publications (First author or equal contribution)

- **Wang, T. K.**, & Shoele, K. (2022). Mode competition in a plunging foil with an active flap: A multiscale modal analysis approach. *Phys. Rev. Fluids*, 7, 044701. [link]
- **Wang, T. K.**, Solano, T., & Shoele, K. (2021). Bridge the gap: correlate face mask leakage and facial features with 3D morphable face models. *Journal of exposure science & environmental epidemiology*, 1-9. [link]
- **Wang, T. K.**, & Shoele, K. (2021). Geometrically weighted modal decomposition techniques. *Journal of Fluid Mechanics*, 911. [link]
- Hu, C. J., **Wang, T. K.**, Huang, C. K., & Lin, P. C. (2019). A torque-actuated dissipative spring loaded inverted pendulum model with rolling contact and its application to hexapod running. *Bioinspiration & biomimetics*, 14(2), 026005. (First two authors contributed equally) [link]

Selected Peer-Reviewed Conference Proceedings (Total: 6)

- **Wang, T. K.**, Tripathi, A., Shahriar, A., Tavanashad, V., Kumar, R., & Shoele, K. (2021). Flow-Informed Vibration-Based Health Monitoring Technique. In *AIAA AVIATION 2021 FORUM* (p. 2495). [link]
- **Wang, T. K.**, & Shoele, K. (2021). Identification of Transient Modes During Formation and Detachment of a Laminar Separation Bubble using Kernel Mode Decomposition. In *AIAA Scitech 2021 Forum* (p. 0248). [link]

Selected Conference Presentations (Total: 6)

- Shoele, K., & **Wang, T. K.** (2021). Geometrically Weighted Modal Decomposition Method for Fluid-Structure Interaction Problems. In *AIAA AVIATION 2021 FORUM* (p. 2826). (Invited talk as the speaker)
- **Wang, T. K.**, & Shoele, K. (2019, November). Separation Bubble Subject to a Compliant Surface: A Linear Approach. In *APS Division of Fluid Dynamics Meeting Abstracts* (pp. S10-001).