ZHUONAN HAO

Ph.D. Candidate in Mechanical Engineering

CONTACT

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EDUCATION

University of California, Los Angeles   **United States**
Doctor of Philosophy, Mechanical and Aerospace Engineering   Jul. 2021 - Now
Advisor: M. Khalid Jawed

University of California, San Diego   **United States**
Master of Science, Mechanical and Aerospace Engineering   Sep. 2019 - Jun. 2021
Thesis: Design principles for locomotion synchronization in undulatory robot groups
Advisor: Nicholas Gravish   GPA: 3.97/4.00

University of Wollongong   **Australia**
Exchange, Mechatronics and Materials Engineering   Jul. 2018 - Jul. 2019
Thesis: A novel semi-active vehicle suspension with a stiffness variable self-powered MR damper
Advisor: Weihua Li   GPA: 3.25/4.00

Beijing Institute of Technology   **China**
Bachelor of Science, Vehicle Engineering   Sep. 2015 - Jul. 2019
Undergraduate Research Honors   GPA: 3.71/4.00

TEACHING

Teaching Assistant, UC San Diego
Course: Computer-Aided Design   Sep. - Dec. 2020

RESEARCH

Structures-Computer Interaction Lab, UC Los Angeles   Jul. 2021 - Now
Research Assistant

Gravish Lab, UC San Diego   Mar.2020 - Jun.2021
Research Assistant

Collective behaviors in swarm robotics system
- Designed the group of snake-like robot system that move through lateral body undulation with n links and $n-1$ controllable joints.
- Introduced the theory of collective gait compatibility taking inspiration from the physics of granular materials and swarm robotics.
- Demonstrated compatible configuration arise passively through intermittent collision events and proposed principles for robot design to achieve compatibility in proximity.

Synchronization of phase oscillator under weak coupling condition
- Proposed a methodology for phase oscillator design under weak coupling condition to achieve phase convergence through self-feedback signal.
- Employed adaptive Hopf oscillator with central pattern generator for robot joint control to realize specific locomotion pattern.
- Explored the applications on swarm robotics system, including the group behavior of snake-like robot for undulatory locomotion and the simple 2-leg robot for tug of war.

Dynamics and Vibration Control Lab, UOW   Dec. 2018 - Jul. 2019
Research Assistant

Application of Magnetorheological Fluid on vehicle suspension
- Modelled a semi-active suspension with a stiffness variable self-powered MR damper.
- Estimated parametric Bouc-Wen model for suspension dynamic and developed the stiffness controller through Short Time Fourier Transform (STFT).
- Compared with passive system, the MR damper can reduce the acceleration and displacement of the sprung mass by 16.8% and 21.44% respectively.

PUBLICATIONS
Published & in review

6. **Z.N. Hao**, W. Zhou, N. Gravish. Synchronized swimming: adaptive gait synchronization through mechanical interactions instead of communication [C]. *Adaptive Motion in Animals and Machines.* 2021.

5. W. Zhou, **Z.N. Hao**, N. Gravish. Collective synchronization of undulatory movement through contact [J]. *Physics Review X.* 2021.

4. W. Zhou, JD Peralta, **Z.N. Hao**, N. Gravish. Lateral contact yields longitudinal cohesion in active undulatory systems [J]. *Physics Review E.* 2021. *In review.*

3. W. Zhou, JD Peralta, **Z.N. Hao**, N. Gravish. Synchronized swimming: collisions drive gait compatibility in undulatory robots [C]. *Bulletin of the American Physical Society.* 2021.

2. X.J. Zhu, D.H. Ning, **Z.N. Hao**, W.H. Li, et al. Modelling and experimental evaluation of a variable stiffness MR suspension with self-powering capability [J]. *Journal of Intelligent Material Systems and Structures.* 2020.

1. L.L. Ren, **Z.N. Hao**. A Simple Fix for Convolutional Neural Network via Coordinate Embedding [J]. *arXiv, pp.arXiv-2003.* 2020.

MANUSCRIPT
In prep

1. **Z.N. Hao**, W.Zhou, N. Gravish. Design principles for emergent synchronization in robot groups through mechanical contact. 2021. *In prep.*

HONORS & AWARDS

Honorable mention for outstanding poster in AMAM 2021   2021
    Virtual poster competition winner, AMAM2021 Virtual Organizing Committee

Outstanding Undergraduate   2019
    Awarded for the exemplary student, Beijing Institute of Technology

China Scholarship Council Scholarships (AUD $20,000)   2018-2019
    National scholarship for studying abroad, China Scholarship Council

Honorable Mention of Mathematical Contest in Modeling   2018
    Top 25% team, COMAP

National Scholarship (CNY ¥8,000)   2017
    Top 1 student in School of Mechanical Engineering, Ministry of Education of P.R.China

National College Students' innovation and entrepreneurship training program (CNY ¥10,000)   2017
    Undergraduate research funds, Ministry of Industry and Information Technology

Annual Merit Undergraduate   2016, 2017
    Best undergraduate student, Beijing Institute of Technology

First Prize of the People's Scholarship (CNY ¥1,100)   2016, 2017, 2018
    Top 5% in School of Mechanical Engineering, Beijing Institute of Technology

Grand Prize of Capital College Students' Summer Holiday Social Practices Collections (Selected as an editors suggestion)   2016
    Coauthor to the best student paper, Beijing Municipal Education Commission

SKILLS

Languages : Matlab, Python, C/C++, HTML
Software : LaTeX, SolidWorks, CAD, ANSYS, COMSOL
Packages : ROS, Simulink, Pybullet, Pychrono, Tensorflow, Keras