

ZHUONAN HAO

M.Sc. in Mechanical Engineering

CONTACT

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EDUCATION

University of California, San Diego <i>Master of Science</i> , Mechanical and Aerospace Engineering Advisor: Nicholas Gravish	United States Sep. 2019 - Now GPA: 3.97/4.00
University of Wollongong <i>Exchange</i> , Mechatronics and Materials Engineering Thesis: A novel semi-active vehicle suspension with a stiffness variable self-powered MR damper Advisor: Weihua Li	Australia Jul. 2018 - Jul. 2019 GPA: 3.25/4.00
Beijing Institute of Technology <i>Bachelor of Science</i> , Vehicle Engineering Undergraduate Research Honors	China Sep. 2015 - Jul. 2019 GPA: 3.71/4.00

TEACHING

Teaching Assistant, UC San Diego Course: Bio-inspired mobile robotics Duty: Instructing graduate students, mentoring laboratory experimental preparation Course: Computer-Aided Design Duty: Mentoring the upper level undergraduate, leading live tutorials about CAD and FEA software, holding office hours, making assignments and exams, and grading	Dec. 2020 - Now Sep. - Dec. 2020
Tutor, Beijing Institute of Technology Course: Linear and Nonlinear Dynamics	Sep. 2018 - Jun. 2019

RESEARCH

Gravish Lab, UC San Diego Research Assistant, supervised by Prof. Nicholas Gravish <i>Emergence of gait compatibility of undulatory swimming robot (ongoing)</i> - Use a specifically designed underwater robot to capture the essential factors (like hydrodynamic force and body contact) that lead to the group synchronization. <i>Collective behaviors in swarm robotics system</i> - 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. <i>Synchronization of phase oscillator under weak coupling condition</i> - 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 Research Assistant, supervised by Prof. Weihua Li <i>Application of Magnetorheological Fluid on vehicle suspension</i> - 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.	Mar.2020 - Now Dec. 2019 - Jul. 2020
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PUBLICATIONS

Published & in review

4. W. Zhou, **Z.N. Hao**, N. Gravish, et al. Spatial reconfiguration through contact enables gait compatibility in collective undulatory locomotion[J]. *Applied Physics Letters*. 2020. *In revision*.
3. 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.
2. L.L. Ren, **Z.N. Hao**. A Simple Fix for Convolutional Neural Network via Coordinate Embedding[J]. *arXiv, pp.arXiv-2003*. 2020.
1. W. Su, **Z.N. Hao**, H.M. Zhou. Design and Practice of the Regulation in Speed with Flywheel. *12th International Conference on Modern Industrial Training*. 2018.

MANUSCRIPT

In prep

1. **Z.N. Hao**, W.Zhou, N. Gravish. Adaptive gait synchronization in undulatory swarms. 2021. *In prep*.

PROJECTS

Perturbation Resilient Central Pattern Generator (PR-CPG) on a Hybrid Bipedal-Wheeled Robot

Bio-inspired Mobile Robotics, instructed by Prof. Nicholas Gravish Jan. - Mar. 2020
- Developed a trajectory control algorithm on legged robot to resolve various road profiles and empower a coupling movement for two legs against external perturbation.
- Compared with PID control, the method generated more flexible and robust locomotion and reacted smoothly for different terrains.

Coordinate-embedded CNN applied on traffic sign detection problem

Statistical Learning, instructed by Prof. Nuno Vasconcelos Jan. - Mar. 2020
- Proposed a simple approach to incorporate the coordinate information to the pre-trained Convolutional Neural Networks models without any changes on architecture.
- Reached an overall 2.47% mAP performance boost on object detection problem.

Design and Practice of the Regulation in Speed with Flywheel

Key National Project, led by Prof. Wei Su May 2017 - May 2018
- Designed and manufactured the experimental system for industrialization to explore the speed fluctuation regulation effect through different types of flywheel.

HONORS & AWARDS

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| Outstanding Undergraduate | 2019 |
| <i>Awarded for the exemplary student, Beijing Institute of Technology</i> | |
| China Scholarship Council Scholarships (AUD \$20,000) | 2018-2019 |
| <i>National scholarship for studying abroad, China Scholarship Council</i> | |
| Honorable Mention of Mathematical Contest in Modeling | 2018 |
| <i>Top 25% team, COMAP</i> | |
| National Scholarship (CNY ¥8,000) | 2017 |
| <i>Top 1 student in School of Mechanical Engineering, Ministry of Education of P.R.China</i> | |
| National College Students' innovation and entrepreneurship training program (CNY ¥10,000) | 2017 |
| <i>Undergraduate research funds, Ministry of Industry and Information Technology</i> | |
| Annual Merit Undergraduate | 2016, 2017 |
| <i>Best undergraduate student, Beijing Institute of Technology</i> | |
| First Prize of the People's Scholarship (CNY ¥1,100) | 2016, 2017, 2018 |
| <i>Top 5% in School of Mechanical Engineering, Beijing Institute of Technology</i> | |
| Grand Prize of Capital College Students' Summer Holiday Social Practices Collections (Selected as an editors suggestion) | 2016 |
| <i>Coauthor to the best student paper, Beijing Municipal Education Commission</i> | |

SKILLS

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