

# TIANYU WANG

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## EDUCATION

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**Georgia Institute of Technology (GT), Atlanta, GA**

Jan 2021 - Present

- PhD in Robotics
- Advisor: Daniel I. Goldman

GPA: 4.0/4.0

**Carnegie Mellon University (CMU), Pittsburgh, PA**

Aug 2018 - May 2020

- MS in Mechanical Engineering
- Thesis: Directional compliance in obstacle-aided navigation for snake robots
- Advisor: Howie Choset

GPA: 4.0/4.0

**Shanghai Jiao Tong University (SJTU), Shanghai, China**

Sep 2014 - Aug 2018

- The University of Michigan-Shanghai Jiao Tong University Joint Institute
- BS in Electrical and Computer Engineering

GPA: 3.61/4.0

## EXPERIENCE

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**Complex Rheology and Biomechanics Lab, GT**

*Graduate Research Assistant*

Jan 2021 - Present

*Advisor: Prof. Daniel I. Goldman*

**Biorobotics Lab, CMU**

*Research Fellow*

May 2020 - Dec 2020

*Advisor: Prof. Howie Choset*

**Biorobotics Lab, CMU**

*Graduate Research Assistant*

Sep 2018 - May 2020

*Advisor: Prof. Howie Choset*

**Soft Robotics and Biodesign Lab, SJTU**

*Undergraduate Research Assistant*

Oct 2016 - Aug 2018

*Advisor: Prof. Guoying Gu*

## PUBLICATIONS

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\* Co-first authorship

### *Preprints*

- [2] V. Kojouharov\*, **T. Wang\***, M. Fernandez, J. Maeng, D. I. Goldman. Anisotropic body compliance facilitates robotic sidewinding in complex environments. 2023. [arxiv](#)
- [1] B. Liu, **T. Wang\***, V. Kojouharov, F. L. Hammond III, D. I. Goldman. Robust self-propulsion in sand using simply controlled vibrating cubes. 2023. [arxiv](#)

### *Refereed Journal Papers*

- [12] **T. Wang\***, C. J. Pierce\*, V. Kojouharov, B. Chong, K. Diaz, H. Lu, D. I. Goldman. Mechanical intelligence simplifies control in terrestrial limbless locomotion. *Science Robotics*, 2023.
- [11] B. Chong, J. He, D. Soto, **T. Wang**, D. Irvine, G. Blekherman, D. I. Goldman. Multi-legged matter transport: a framework for locomotion on noisy landscapes. *Science*, 2023.
- [10] B. Chong, **T. Wang**, B. Lin, S. Li, P. Muthukrishnan, J. He, D. Irvine, H. Choset, G. Blekherman and D. I. Goldman. Optimizing contact patterns for robot locomotion via geometric mechanics. *The International Journal of Robotics Research*, 2023.

- [9] B. Chong, J. He, S. Li, E. Erickson, K. Diaz, **T. Wang**, D. Soto, D. I. Goldman. Self-propulsion via slipping: Frictional swimming in multilegged locomotors. *The Proceedings of the National Academy of Sciences (PNAS)*, 2023.
- [8] S. Li\*, **T. Wang\***, V. H. Kojouharov, J. McInerney, E. Aydin, Y. Ozkan-Aydin, D. I. Goldman, D. Z. Rocklin. Robotic swimming in curved space via geometric phase. *The Proceedings of the National Academy of Sciences (PNAS)*, 2022.
- [7] B. Chong, **T. Wang**, E. Erickson, P. J. Bergmann, D. I. Goldman. Coordinating tiny limbs and long bodies: geometric mechanics of diverse undulatory lizard locomotion. *The Proceedings of the National Academy of Sciences (PNAS)*, 2022.
- [6] B. Chong, Y. O. Aydin, J. M. Rieser, G. Sartoretti, **T. Wang**, J. Whitman, A. Kaba, E. Aydin, C. McFarland, H. Choset and D. I. Goldman. A general locomotion control framework for serially connected multi-legged robots. *Bioinspiration & Biomimetics*, 2022.
- [5] B. Chong\*, **T. Wang\***, J. Rieser, B. Lin, A. Kaba, G. Blekherman, H. Choset and D. I. Goldman. Frequency modulation of body waves to improve performance of sidewinding robots. *The International Journal of Robotics Research*, 2021.
- [4] **T. Wang\***, B. Lin\*, B. Chong, J. Whitman, M. Travers, D. I. Goldman, G. Blekherman, H. Choset. Reconstruction of Backbone Curves for Snake Robots. *IEEE Robotics and Automation Letters*, 2021.
- [3] **T. Wang\***, L. Ge\*, and G. Gu. Programmable design of soft pneu-net actuators with oblique chambers can generate coupled bending and twisting motions. *Sensors and Actuators A: Physical*, 2018.
- [2] L. Ge\*, **T. Wang\***, N. Zhang, and G. Gu. Fabrication of soft pneumatic network actuators with oblique chambers. *Journal of Visualized Experiments*, 2018.
- [1] S. Wei, **T. Wang**, and G. Gu. Design of a soft pneumatic robotic gripper based on fiber-reinforced actuator. *Chinese Journal of Mechanical Engineering*, 2017.

### **Refereed Conference Papers**

- [7] B. Chong, **T. Wang**, D. Irvine, V. Kojouharov, B. Lin, H. Choset, D. I. Goldman, G. Blekherman. Gait design for limbless obstacle aided locomotion using geometric mechanics. *Robotics: Science and Systems*, 2023.
- [6] **T. Wang\***, B. Chong\*, Y. Deng, R. Fu, H. Choset, D. I. Goldman. Generalized omega turn gait enables agile limbless robot turning in complex environments. *IEEE International Conference on Robotics and Automation (ICRA)*, 2022.
- [5] B. Chong, **T. Wang**, B. Lin, S. Li, G. Blekherman, H. Choset, D. I. Goldman. Moving sidewinding forward: optimizing contact patterns for limbless robots via geometric mechanics. *Robotics: Science and Systems*, 2021. **Best Paper Award Finalist**
- [4] G. Sartoretti, **T. Wang**, G. Chuang, Q. Li, H. Choset. Autonomous decentralized shape-based navigation for snake robots in dense environments. *IEEE International Conference on Robotics and Automation (ICRA)*, 2021.
- [3] **T. Wang\***, B. Chong\*, K. Diaz, J. Whitman, H. Lu, M. Travers, D. I. Goldman and H. Choset. The omega turn: a biologically-inspired turning strategy for elongated limbless robots. *IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2020.
- [2] B. Chong, **T. Wang**, J. Rieser, A. Kaba, H. Choset and D. I. Goldman. Frequency modulation of body waves to improve performance of limbless robots. *Robotics: Science and Systems*, 2020.
- [1] **T. Wang**, J. Whitman, M. Travers, and H. Choset. Directional compliance in obstacle-aided navigation for snake robots. *American Control Conference*, 2020.

### **Thesis**

- [1] **T. Wang**. Directional compliance in obstacle-aided navigation for snake robots. Master's thesis, Carnegie Mellon University, Pittsburgh, Pennsylvania

### **Conference Abstracts/Posters**

- [23] **T. Wang**, C. Pierce, V. Kojouharov, K. Diaz, B. Chong, H. Lu, D. I. Goldman. Lattice transport via mechanical intelligence in undulatory locomotors. *American Physical Society March Meeting*, 2023.

- [22] V. Kojouharov, **T. Wang**, C. Pierce, K. Diaz, B. Zhong, D. I. Goldman. Compliant cable-driven limbless robot for complex terrain navigation. *American Physical Society March Meeting*, 2023.
- [21] J. He, B. Chong, S. Li, E. Erickson, K. Diaz, **T. Wang**, D. Soto, D. I. Goldman. Terrestrial swimming in multilegged robots. *American Physical Society March Meeting*, 2023.
- [20] B. Chong, J. He, D. Soto, **T. Wang**, Daniel Irvine, Daniel I. Goldman. A Shannon-inspired framework for multi-legged matter transport. *American Physical Society March Meeting*, 2023.
- [19] **T. Wang**, V. Kojouharov, C. Pierce, K. Diaz, B. Chong, V. Zborovsky, D. I. Goldman. Robophysical modeling reveals the role of passive body mechanics in *C. elegans* locomotion. *SICB Annual Meeting*, 2023.
- [18] V. Kojouharov, **T. Wang**, C. Pierce, K. Diaz, B. Chong, V. Zborovsky, D. Soto, D. I. Goldman. Bilateral actuation mechanism for complex terrain navigation in limbless robots. *SICB Annual Meeting*, 2023.
- [17] B. Chong, J. He, S. Li, E. Erickson, K. Diaz, **T. Wang**, D. Soto, D. I. Goldman. Self-propulsion via slipping: frictional swimming in multi-legged locomotors. *SICB Annual Meeting*, 2023.
- [16] D. Soto, E. Erickson, K. Diaz, **T. Wang**, V. Kojouharov, D. I. Goldman. Novel terradynamic interactions in myriapod locomotion in obstacle-rich environments. *SICB Annual Meeting*, 2023.
- [15] **T. Wang**, V. Kojouharov and D. I. Goldman. A novel limbless robot for complex terrain navigation via passive mechanical interactions. *GT IRIM Robotics Research Showcase*, 2022. **Best Poster Award**
- [14] **T. Wang**, D. Z. Rocklin, D. L. Hu and D. I. Goldman. Experiment and analysis of limbless robot locomotion in heterogeneous environment from a macroscopic perspective. *GT IRIM Robotics Research Showcase*, 2022.
- [13] **T. Wang**, B. Chong, Y. Deng, R. Fu, H. Choset, D. I. Goldman. Worm omega turn modeling and its limbless robot implementation via geometric mechanics. *American Physical Society March Meeting*, 2022.
- [12] J. He, **T. Wang**, B. Chong, K. Diaz, E. Erickson, D. I. Goldman. Mismatch of body undulation and limb waves enables robust centipede locomotion. *American Physical Society March Meeting*, 2022.
- [11] S. Li, **T. Wang**, V. Kojouharov, D. I. Goldman, D. Z. Rocklin, Y. Ozkan-Aydin, E. Aydin. Robotic swimming in curved space via geometric phase. *American Physical Society March Meeting*, 2022.
- [10] E. Erickson, K. Diaz, **T. Wang**, B. Chong, J. He, D. I. Goldman. Gait transitions in centipede locomotion on complex terrains. *SICB Annual Meeting*, 2022.
- [9] **T. Wang**, M. C. Maisonneuve, K. Diaz, P. E. Schiebel, D. I. Goldman. Complex terrain navigation via passive mechanical interactions in a novel limbless robot. *SICB Annual Meeting*, 2022.
- [8] **T. Wang**, B. Chong, J. He, K. Diaz, E. Erickson, D. I. Goldman. Robophysical modeling of the coordination between body undulation and leg movement in centipedes. *SICB Annual Meeting*, 2022.
- [7] B. Chong, **T. Wang**, E. Erickson, P. J. Bergmann, D. I. Goldman. Body-leg coordination in lizard locomotion along the body elongation and limb reduction continuum. *SICB Annual Meeting*, 2022.
- [6] **T. Wang**, B. Lin, B. Chong, J. Whitman, M. Travers, D. I. Goldman, H. Choset, G. Blekherman. Reconstruction of Backbone Curves for 3-D Locomotion of Limbless Robots. *American Physical Society March Meeting*, 2021.
- [5] **T. Wang**, B. Chong, K. Diaz, J. Whitman, H. Lu, M. Travers, D. I. Goldman and H. Choset. A Biologically Inspired Omega-Shaped Turning Gait for Elongated Limbless Robots. *American Physical Society March Meeting*, 2021.
- [4] **T. Wang**, B. Chong, K. Diaz, J. Whitman, H. Lu, M. Travers, D. I. Goldman and H. Choset. The omega turn: a biologically-inspired turning strategy for elongated limbless robots. *Workshop: Robotics-Inspired Biology in 2020 IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2020.
- [3] **T. Wang**, J. Whitman, M. Travers, and H. Choset. Directional compliance in snake robot obstacle-aided locomotion. *American Physical Society March Meeting*, 2020.
- [2] K. Diaz, B. Chong, **T. Wang**, K. Bates, J. Ding, G. Sartoretti, H. Lu, H. Choset, D. I. Goldman. Steering and turning control of *C. elegans*. *American Physical Society March Meeting*, 2020.
- [1] K. Diaz, **T. Wang**, B. Chong, J. Ding, H. Lu, G. Sartoretti, H. Choset, D. I. Goldman. Steering behaviors of *C. elegans* locomotion in heterogeneous environments. *SICB Annual Meeting*, 2020.

## Patents

- [2] **T. Wang**, V. Kojouharov, and D. I. Goldman, Devices and systems for locomoting diverse terrain and

methods of use. *US Patent (filed)*.

- [1] G. Gu, L. Dong, **T. Wang**, and X. Zhu, Force feedback apparatus in bottom-up DLP 3D printers for soft materials. *China Patent, CN108081596A*, 2017.

## INVITED TALKS

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- Seattle Robotics Society Monthly Meeting: Mechanical intelligence in undulatory locomotion 2023
- NSF Physics of Living Systems (PoLS) Seminar: Mechanical intelligence in undulatory locomotion 2022
- Georgia Tech RoboGrads Student Seminar: Generalized omega turn gait enables agile limbless robot turning in complex environments 2022
- NSF Physics of Living Systems (PoLS) Seminar: Nematode omega turns improve reorientation in a limbless robot 2022

## GRANT PREPARATION

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- [1] **NSF Physics of Living Systems Award #2310751 (\$629,951)** PI: Daniel I. Goldman 2023  
Wrote one of three aims supporting my limbless robot research.

## FELLOWSHIPS AND AWARDS

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- Topping Fellowship for research excellence 2023
- *Georgia Tech IRIM Robotics Research Showcase* Best Poster Award 2022
- *Robotics: Science and Systems* (RSS) Best Paper Finalist 2021
- SJTU Academic Excellence Scholarship 2015, 2016, 2017, 2018
- Silver Medal in Advanced Vision Challenge, RoboCup China Open 2016
- Covidien Scholarship 2014

## TEACHING EXPERIENCE

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<b>SJTU VM467 Introduction to Robotics</b> <i>Teaching Assistant</i>	Spring 2018 <i>Instructor: Prof. Yu Zheng</i>
<b>SJTU VE216 Signal and System</b> <i>Teaching Assistant</i>	Spring 2017 <i>Instructor: Prof. Mohamed Atef</i>

## ACADEMIC ACTIVITIES AND SERVICES

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### *Workshop Organizer*

- *Agile Movements II: Animal Behavior, Biomechanics, and Robot Devices*, IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan, May 2024. [Link](#)
- *Agile Movements: Animal Behavior, Biomechanics, and Robot Devices*, IEEE International Conference on Robotics and Automation (ICRA), London, the United Kingdom, May 2023. [Link](#)

### *Reviewer (Journals)*

- The International Journal of Robotics Research (IJRR)
- IEEE Transactions on Robotics (T-RO)
- IEEE Robotics & Automation Letters (RA-L)
- Soft Robotics
- Nonlinear Dynamics

## ***Reviewer (Conferences)***

- IEEE International Conference on Intelligent Robots and Systems (IROS)
- IEEE Conference on Robotics and Automation (ICRA)
- American Control Conference (ACC)

## **MEDIA**

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**Scurrying Centipedes Inspire Many-Legged Robots That Can Traverse Difficult Landscapes** (by *Georgia Tech Research News*) 2023

[Article link](#)   [YouTube link](#)

**Robotic Motion in Curved Space Defies Standard Laws of Physics** (by *Georgia Tech Research News*) 2022

[Article link](#)   [YouTube link](#)

**Tiny Limbs and Long Bodies: Coordinating Lizard Locomotion** (by *Georgia Tech Research News*) 2022

[Article link](#)   [YouTube link](#)

**These Search and Rescue Robots Could Save Your Life** (by *Freethink*) 2019

[Article link](#)   [YouTube link](#)

## **PROFESSIONAL ASSOCIATIONS**

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### ***Professional Societies***

- Student member, Institute of Electrical and Electronics Engineers (IEEE)
- Student member, American Physical Society (APS)
- Student member, Society for Integrative and Comparative Biology (SICB)

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