TIANYU WANG

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Education

Georgia Institute of Technology (GT), Atlanta, GA — Jan 2021 - Present
PhD in Robotics — GPA: 4.0/4.0
Advisor: Daniel I. Goldman

Carnegie Mellon University (CMU), Pittsburgh, PA — Aug 2018 - May 2020
MS in Mechanical Engineering — GPA: 4.0/4.0
Thesis: Directional compliance in obstacle-aided navigation for snake robots
Advisor: Howie Choset

Shanghai Jiao Tong University (SJTU), Shanghai, China — Sep 2014 - Aug 2018
The University of Michigan-Shanghai Jiao Tong University Joint Institute — GPA: 3.61/4.0
BS in Electrical and Computer Engineering
Research advisor: Guoying Gu

Experience

Complex Rheology and Biomechanics Lab, GT — Jan 2021 - Present
Graduate Research Assistant
Advisor: Daniel I. Goldman

Biorobotics Lab, CMU — May 2020 - Dec 2020
Research Staff
Advisor: Howie Choset

Biorobotics Lab, CMU — Sep 2018 - May 2020
Graduate Research Assistant
Advisor: Prof. Howie Choset

Soft Robotics and Biodesign Lab, SJTU — Oct 2016 - Aug 2018
Undergraduate Research Assistant
Advisor: Guoying Gu

Publications

* Co-first authorship

Preprints

[1] B. Liu*, **T. Wang***, D. Kerimoglu, V. Kojouharov, F. L. Hammond III, D. I. Goldman. Robust self-propulsion in sand using simply controlled vibrating cubes. 2024. arxiv

Refereed Journal Papers

[J12] **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.

[J11] 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.

[J10] 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 (IJRR)*, 2023.

[J9] 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.

[J8] S. Li*, **T. Wang***, V. 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.

[J7] 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.

[J6] 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.

[J5] 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 (IJRR)*, 2021.

[J4] **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 (RA-L)*, 2021.

[J3] **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.

[J2] L. Ge*, **T. Wang***, N. Zhang, and G. Gu. Fabrication of soft pneumatic network actuators with oblique chambers. *Journal of Visualized Experiments*, 2018.

[J1] 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

[C8] V. Kojouharov*, **T. Wang***, M. Fernandez, J. Maeng, D. I. Goldman. Anisotropic body compliance facilitates robotic sidewinding in complex environments. *IEEE International Conference on Robotics and Automation (ICRA)*, 2024.

[C7] 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 (RSS)*, 2023.

[C6] **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.

[C5] 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 (RSS)*, 2021. **Best Paper Award Finalist**

[C4] 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.

[C3] **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.

[C2] 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 (RSS)*, 2020.

[C1] **T. Wang**, J. Whitman, M. Travers, and H. Choset. Directional compliance in obstacle-aided navigation for snake robots. *American Control Conference (ACC)*, 2020.

Thesis

[T1] **T. Wang**. Directional compliance in obstacle-aided navigation for snake robots. Master's thesis, Carnegie Mellon University.

Conference Abstracts/Posters

[A31] **T. Wang**, B. Chong, A. Bhumkar, V. Kojouharov, C. Pierce, D. I. Goldman. Gait design and mechanical intelligence facilitate open-loop limbless obstacle aided locomotion. *American Physical Society March Meeting*, 2024.

[A30] V. Kojouharov, **T. Wang**, M. Fernandez, J. Maeng, D. I. Goldman. Anisotropic body compliance facilitates robotic sidewinding in complex environments. *American Physical Society March Meeting*, 2024.

[A29] N. Mankame, **T. Wang**, M. Fernandez, C. Pierce, D. I. Goldman. Mechanical intelligence facilitates limbless locomotion in cluttered aquatic environments. *American Physical Society March Meeting*, 2024.

[A28] B. Chong, D. Luo, **T. Wang**, G. Margolis, Z. Xu, M. Iaschi, P. Agrawal, M. Soljacic, D. I. Goldman. Geometry of contact: contact planning for multi-legged robots via spin models. *American Physical Society March Meeting*, 2024.

[A27] **T. Wang**. Mechanical intelligence in undulatory locomotors. *Gordon Research Conference: Robotics*, 2024.

[A26] **T. Wang**. Mechanical intelligence in undulatory locomotors. *Gordon Research Seminar: Robotics*, 2024.

[A25] **T. Wang**, N. Mankame, A. Bhumkar, V. Kojouharov, C. Pierce, D. I. Goldman. Physical intelligence aids limbless locomotion in cluttered aquatic environments. *SICB Annual Meeting*, 2024.

[A24] B. Chong, J. He, K. Diaz, **T. Wang**, D. Irvine, D. Soto, Y. Ozkan-Aydin, G. Blekherman, D. I. Goldman. Physical intelligence in centipede limbs facilitate reliable locomotion on rugose terrain. *SICB Annual Meeting*, 2024.

[A23] **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.

[A22] 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.

[A21] 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.

[A20] 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.

[A19] **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.

[A18] 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.

[A17] 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.

[A16] 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.

[A15] **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**

[A14] **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.

[A13] **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.

[A12] 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.

[A11] 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.

[A10] 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.

[A9] **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.

[A8] **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.

[A7] 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.

[A6] **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.

[A5] **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.

[A4] **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.

[A3] **T. Wang**, J. Whitman, M. Travers, and H. Choset. Directional compliance in snake robot obstacle-aided locomotion. *American Physical Society March Meeting*, 2020.

[A2] 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.

[A1] 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

[P2] **T. Wang**, V. Kojouharov, and D. I. Goldman, Devices and systems for locomoting diverse terrain and methods of use. *US Patent (filed 2022)*.

[P1] 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.

Fellowships and Awards

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

Grant Preparation

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

Invited Talks

CMU Safe AI Lab Apr 2024
Seattle Robotics Society Monthly Meeting Jun 2023
NSF Physics of Living Systems (PoLS) Seminar Oct 2022
Georgia Tech RoboGrads Student Seminar Apr 2022
NSF Physics of Living Systems (PoLS) Seminar Feb 2022

Teaching Experience

SJTU VM467 Introduction to Robotics Spring 2018
Teaching Assistant
Instructor: Prof. Yu Zheng

SJTU VE216 Signal and System Spring 2017
Teaching Assistant
Instructor: Prof. Mohamed Atef

Academic Activities and Services

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

Conference Chair

- **Discussion Leader**, Session *"Improved Performance Due to a Combination of Hard and Soft Elements"*, Gordon Research Seminar, Ventura, CA, United States, January 2024.

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)

Press

Worms Inspire Wiggly Robots That Navigate All Landscapes (by *Georgia Tech Research News*) 2024
Article link YouTube link

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

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