Fuchen Chen

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EDUCATION

PhD Student, Systems Engineering — January 2021 - Present
Arizona State University, Mesa, AZ
Advisor: Professor Daniel M. Aukes

Master of Science, Robotics Engineering — August 2016 - December 2017
Worcester Polytechnic Institute, Worcester, MA

Bachelor of Science, Robotics Engineering — August 2012 - May 2016
Worcester Polytechnic Institute, Worcester, MA

RESEARCH EXPERIENCE

Graduate Research Assistant, IDEA Lab, Arizona State University, Mesa, AZ — January 2021 - Present

- Built a reinforcement learning framework for Sim2Real control and design tuning of a quadruped platform.
- Designed and built an accessible, affordable dynamic quadruped robot with tunable, compliant legs for research and education.
- Studied stiffness tuning of a robot leg made from folded multi-layer, multi-material laminates through design optimization, modeling, and experimentation.

Research Assistant, Soft Robotics Lab, Worcester Polytechnic Institute, Worcester, MA — May 2013 - May 2016

- Developed a systematic and modular origami-inspired robot fabrication method that cuts and folds single-layer plastic sheets into various legged and aerial robots.
- Designed and fabricated modular and reliable soft pneumatic actuators with integrated sensors for a soft snake robot.

PROFESSIONAL EXPERIENCE

Cofounder, Orimagi, Inc., Boston, MA, — December 2017 - December 2020

- Commercialized my origami-inspired robots research into an educational robot toy product and sold over a thousand of them to families and schools.
- Developed all technical aspects of the product, including all the mechanical parts, PCBs, firmware, smartphone apps, and packaging.
- Contacted and worked with manufacturers to mass produce and certify the product.
- Involved closely in product iterations, playtesting, events, and sales.

PUBLICATIONS

- F. Chen, W. Tao, and D. M. Aukes, “Development of A Dynamic Quadruped with Tunable, Compliant Legs,” in *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Detroit, MI, USA: IEEE, Oct. 2023, pp. 495–502. doi: 10.1109/IROS55552.2023.10342283.
- W. Tao, K. Patnaik, F. Chen, Y. Kumar, and W. Zhang, “Design, Characterization and Control of a Whole-body Grasping and Perching (WHOPPEr) Drone,” in *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2023, pp. 1–7. doi: 10.1109/IROS55552.2023.10341722.
- Y. Jiang, F. Chen, and D. M. Aukes, “Tunable Dynamic Walking via Soft Twisted Beam Vibration,” *IEEE Robot. Autom. Lett.*, vol. 8, no. 4, pp. 1967–1974, Apr. 2023, doi: 10.1109/LRA.2023.3244716.
- F. Chen and D. M. Aukes, “Direct Encoding of Tunable Stiffness Into an Origami-Inspired Jumping Robot

Leg," *Journal of Mechanisms and Robotics*, vol. 16, no. 3, Mar. 2023, doi: 10.1115/1.4056958.
- M. Luo *et al.*, "Motion Planning and Iterative Learning Control of a Modular Soft Robotic Snake," *Frontiers in Robotics and AI*, vol. 7, 2020, doi: 10.3389/frobt.2020.599242.
- E. H. Skorina *et al.*, "Reverse pneumatic artificial muscles (rPAMs): Modeling, integration, and control," *PLoS ONE*, vol. 13, no. 10, p. e0204637, Oct. 2018, doi: 10.1371/journal.pone.0204637.
- E. H. Skorina, M. Luo, W. Tao, F. Chen, J. Fu, and C. D. Onal, "Adapting to Flexibility: Model Reference Adaptive Control of Soft Bending Actuators," *IEEE Robot. Autom. Lett.*, vol. 2, no. 2, pp. 964–970, Apr. 2017, doi: 10.1109/LRA.2017.2655572.
- M. Luo *et al.*, "Toward Modular Soft Robotics: Proprioceptive Curvature Sensing and Sliding-Mode Control of Soft Bidirectional Bending Modules," *Soft Robotics*, vol. 4, no. 2, pp. 117–125, Jun. 2017, doi: 10.1089/soro.2016.0041.
- E. H. Skorina, W. Tao, F. Chen, M. Luo, and C. D. Onal, "Motion control of a soft-actuated modular manipulator," in *2016 IEEE International Conference on Robotics and Automation (ICRA)*, Stockholm, Sweden: IEEE, May 2016, pp. 4997–5002. doi: 10.1109/ICRA.2016.7487706.
- S. Ozel *et al.*, "A composite soft bending actuation module with integrated curvature sensing," in *2016 IEEE International Conference on Robotics and Automation (ICRA)*, Stockholm, Sweden: IEEE, May 2016, pp. 4963–4968. doi: 10.1109/ICRA.2016.7487703.
- S. G. Faal *et al.*, "Design, Fabrication, Experimental Analysis, and Test Flight of an Origami-Based Fixed-Wing Aerial Vehicle: μPlane," presented at the ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, American Society of Mechanical Engineers Digital Collection, Dec. 2016. doi: 10.1115/DETC2016-60477.
- W. Tao, E. H. Skorina, F. Chen, J. McInnis, M. Luo, and C. D. Onal, "Bioinspired design and fabrication principles of reliable fluidic soft actuation modules," in *2015 IEEE International Conference on Robotics and Biomimetics (ROBIO)*, Zhuhai: IEEE, Dec. 2015, pp. 2169–2174. doi: 10.1109/ROBIO.2015.7419095.
- E. H. Skorina, M. Luo, S. Ozel, F. Chen, W. Tao, and C. D. Onal, "Feedforward augmented sliding mode motion control of antagonistic soft pneumatic actuators," in *2015 IEEE International Conference on Robotics and Automation (ICRA)*, Seattle, WA, USA: IEEE, May 2015, pp. 2544–2549. doi: 10.1109/ICRA.2015.7139540.
- M. Luo, E. H. Skorina, W. Tao, F. Chen, and C. D. Onal, "Optimized design of a rigid kinematic module for antagonistic soft actuation," in *2015 IEEE International Conference on Technologies for Practical Robot Applications (TePRA)*, Woburn, MA, USA: IEEE, May 2015, pp. 1–6. doi: 10.1109/TePRA.2015.7219694.
- M. Luo, Y. Pan, W. Tao, F. Chen, E. H. Skorina, and C. D. Onal, "Refined Theoretical Modeling of a New-Generation Pressure-Operated Soft Snake," in *Volume 5C: 39th Mechanisms and Robotics Conference*, Boston, Massachusetts, USA: American Society of Mechanical Engineers, Aug. 2015, p. V05CT08A023. doi: 10.1115/DETC2015-47515.
- M. Luo *et al.*, "Slithering towards autonomy: a self-contained soft robotic snake platform with integrated curvature sensing," *Bioinspir. Biomim.*, vol. 10, no. 5, p. 055001, Sep. 2015, doi: 10.1088/1748-3190/10/5/055001.
- S. G. Faal, F. Chen, W. Tao, M. Agheli, S. Tasdighikalat, and C. D. Onal, "Hierarchical Kinematic Design of Foldable Hexapedal Locomotion Platforms," *Journal of Mechanisms and Robotics*, vol. 8, no. 1, Aug. 2015, doi: 10.1115/1.4030468.
- M. Luo, W. Tao, F. Chen, T. K. Khuu, S. Ozel, and C. D. Onal, "Design improvements and dynamic characterization on fluidic elastomer actuators for a soft robotic snake," in *2014 IEEE International Conference on Technologies for Practical Robot Applications (TePRA)*, Woburn, MA, USA: IEEE, Apr. 2014, pp. 1–6. doi: 10.1109/TePRA.2014.6869154.

- M. Agheli, S. G. Faal, F. Chen, H. Gong, and C. D. Onal, “Design and fabrication of a foldable hexapod robot towards experimental swarm applications,” in *2014 IEEE International Conference on Robotics and Automation (ICRA)*, May 2014, pp. 2971–2976. doi: 10.1109/ICRA.2014.6907287.

PRESENTATIONS

- Steerable Walking with Vibrating Soft Twisted Beams, Democratization Workshop, IEEE-RAS International Conference on Soft Robotics, April 2024 (RoboSoft 2024)
- Development of A Dynamic Quadruped with Tunable, Compliant Legs, IEEE/RSJ International Conference on Intelligent Robots and Systems, October 2023 (IROS 2023)
- Direct Encoding of Tunable Stiffness Into an Origami-Inspired Jumping Robot Leg, ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, August 2023 (IDETC-CIE 2023)
- Design, fabrication, experimental analysis, and test flight of an origami-based fixed-wing aerial vehicle: μPlane, ASME International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, August 2016 (IDETC-CIE 2016)

PATENT

- C. D. Onal, F. Chen, and W. Tao, “Fabrication of robotic mechanisms and systems from planar substrates,” US10478975B2, Nov. 19, 2019

AWARDS

- First Place in IEEE Robotics and Automation Society Soft Material Robot Challenge (SMRC) 2017 Soft Robot Speed Challenge, IEEE International Conference on Robotics and Automation 2017 (ICRA 2017)
- Worcester Polytechnic Institute Summer Undergraduate Research Fellowships 2014