

Tarik Tosun

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Research Interests

I am currently a Robotics Research Scientist at the New York Samsung AI Center, where I work on deep learning for robotic manipulation.

I recently completed my Ph.D in Mechanical Engineering at the University of Pennsylvania with Mark Yim in the ModLab, part of GRASP. During my Ph.D, I developed robots that can transform between different shapes (like a car, snake, or arm) and build structures. My research focused on hardware design and planning algorithms for transforming robots.

Employment

October 2018–Present **Robotics Research Scientist**, *Samsung AI Center*, New York, NY.
Working on research related to deep learning for low-cost manipulation

Education

2012–2018 **Ph.D, Mechanical Engineering and Applied Mechanics.**
University of Pennsylvania GRASP Lab, Philadelphia PA
Advisor: Mark Yim
Thesis: *Addressing Tasks Through Robot Adaptation*

2008–2012 **BSE, Mechanical and Aerospace Engineering.**
Princeton University, Princeton NJ
Certificates in Computer Science and Robotics

Honors

- 2017 **John A. Goff Award**, *University of Pennsylvania.*
Highest academic award for a Ph.D student in the Mechanical Engineering and Applied Mechanics department, awarded annually
- 2016 **Best Systems Paper Winner, and Nominee for Best Student Paper and Best Conference Paper**, *2016 Robotics: Science and Systems Conference.*
For “An End-to-End System for Accomplishing Tasks with Modular Robots”
- 2014–2018 **NSF Graduate Research Fellow**, *University of Pennsylvania.*
- 2014 **Best Automation Paper**, *2014 IEEE International Conference on Robotics and Automation.*
For “Self-Assembly of a swarm of autonomous boats into floating structures”
- 2012 **Donald Janssen Dike Award, Second Place**, *Princeton University.*
For Excellence in Undergraduate Research

2011 **Tau Beta Pi**, *Princeton University*.
Engineering Honor Society

Academic Advising and Management

2014–2017 **SMORES-EP Project Lead**, University of Pennsylvania.

Mentored a total of 24 students over the course of the project (2 junior Ph.Ds, 8 Master's, 11 undergraduates, 3 high school). The team was largest in summer 2015, with 15 students working under me to design, build, and program the SMORES-EP robot system.

2017–2018 **Undergraduate and High School Research Mentor**, University of Pennsylvania.

- **Colin McCloskey** (Yale University), 2018. Summer research internship, culminating in co-authorship on a journal paper (Optimal Structure Synthesis for Environment Augmenting Robots)
- **Sanjna Ravichandar** (West Windsor-Plainsboro High School), 2017. Python programming for SMORES-EP. Sanjna is now an undergraduate at MIT.

2013–2014 **NSF REU Mentor**, University of Pennsylvania.

Mentored three summer interns through the NSF Research Experience for Undergraduates program.

- **Jean Mendez** (University of Puerto Rico), 2013. Real-Time Kinematic Retargeting with CKbots.
- **Terry Sun** (University of Pennsylvania), 2013. Real-Time Kinematic Retargeting with CKbots.
- **Kam Hou U** (Stony Brook University), 2014. Wireless communication networking for SMORES-EP.

Teaching

2013–2014 **Teaching Assistant**, University of Pennsylvania.

Responsibilities included weekly tutorial sessions and office hours, grading lab reports, and some lecturing.

- MEAM 347 Core Laboratory (Fall 2014)
- MEAM 516 Advanced Mechatronics in Reactive Spaces (Fall 2014)
- MEAM 210 Dynamics (Spring 2014)
- MEAM 510 Mechatronics (Fall 2013)

Journal Articles

- [1] T. Tosun, C. Sung, C. McCloskey, and M. Yim, “Optimal structure synthesis for environment augmenting robots,” *Robotics and Automation Letters (Accepted)*, 2019. [Online]. Available: <https://arxiv.org/pdf/1812.04190.pdf>.
- [2] J. Daudelin*, G. Jing*, T. Tosun*, M. Yim, H. Kress-Gazit, and M. Campbell, “An integrated system for perception-driven autonomy with modular robots,” *Science Robotics*, 2018. DOI: 10.1126/scirobotics.aat4983. [Online]. Available: <http://robotics.sciencemag.org/cgi/content/full/3/23/eaat4983?ijkey=iBq7yW7Z8vmjE&keytype=ref&siteid=robotics>.
- [3] G. Jing, T. Tosun, M. Yim, and H. Kress-Gazit, “Accomplishing high-level tasks with modular robots,” *Autonomous Robots*, 2018. DOI: 10.1007/s10514-018-9738-1. [Online]. Available: <https://arxiv.org/abs/1712.02299>, **Invited Paper**.
- [4] J. Paulos, N. Eckenstein, T. Tosun, J. Seo, J. Davey, J. Greco, V. Kumar, and M. Yim, “Automated self-assembly of large maritime structures by a team of robotic boats,” *IEEE Trans-*

actions on Automation Science and Engineering, vol. 12, no. 3, pp. 958–968, 2014. [Online]. Available: <http://www.tariktosun.com/wp-content/uploads/paulos2014automated.pdf>.

Refereed Conference Papers

- [0] T. Tosun*, E. Mitchell*, B. Eisner, J. Huh, B. Lee, D. Lee, V. Isler, H. S. Seung, and D. Lee, “Pixels to plans: Learning non-prehensile manipulation by imitating a planner,” in *IEEE International Conference on Intelligent Robots and Systems (IROS)*, IEEE, 2019. [Online]. Available: <https://arxiv.org/pdf/1904.03260.pdf>.
- [1] T. Tosun*, J. Daudelin*, G. Jing*, H. Kress-Gazit, M. Campbell, and M. Yim, “Perception-informed autonomous environment augmentation with modular robots,” in *IEEE International Conference on Robotics and Automation*, 2018. [Online]. Available: <https://arxiv.org/abs/1710.01840>.
- [2] G. Jing, T. Tosun, M. Yim, and H. Kress-Gazit, “An end-to-end system for accomplishing tasks with modular robots: Perspectives for the ai community,” in *International Joint Conference on Artificial Intelligence*, 2017. [Online]. Available: <http://static.ijcai.org/proceedings-2017/0686.pdf>, **Invited Paper**.
- [3] T. Tosun, D. Edgar, C. Liu, T. Tsabedze, and M. Yim, “Paintpots: Low cost, accurate, highly customizable potentiometers for position sensing,” in *IEEE International Conference on Robotics and Automation*, 2017, pp. 1212–1218. [Online]. Available: <http://www.tariktosun.com/wp-content/uploads/tosun2017paintpots.pdf>.
- [4] T. Tosun, J. Davey, C. Liu, and M. Yim, “Design and characterization of the ep-face connector,” in *IEEE International Conference on Intelligent Robots and Systems (IROS)*, IEEE, 2016, pp. 45–51. [Online]. Available: <http://www.tariktosun.com/wp-content/uploads/tosun2016epface.pdf>, **Conference Highlight Paper**.
- [5] G. Jing, T. Tosun, M. Yim, and H. Kress-Gazit, “An end-to-end system for accomplishing tasks with modular robots,” in *Robotics: Science and Systems*, 2016. DOI: 10.15607/RSS.2016.XII.025. [Online]. Available: <http://www.tariktosun.com/wp-content/uploads/jing2016system.pdf>, **Best Systems Paper Award Winner**.
- [6] T. Tosun*, G. Jing*, H. Kress-Gazit, and M. Yim, “Computer-aided compositional design and verification for modular robots,” in *International Symposium on Robotics Research*, 2015, pp. 237–252. [Online]. Available: <http://www.tariktosun.com/wp-content/uploads/tosun2015computer.pdf>.
- [7] Y. Mantzouratos*, T. Tosun*, S. Khanna, and M. Yim, “On embeddability of modular robot designs,” in *IEEE International Conference on Robotics and Automation*, 2015, pp. 1911–1918. [Online]. Available: <http://www.tariktosun.com/wp-content/uploads/mantzouratos2015embeddability.pdf>.
- [8] T. Tosun, R. Mead, and R. Stengel, “A general method for kinematic retargeting: Adapting poses between humans and robots,” in *ASME 2014 International Mechanical Engineering Congress and Exposition*, 2014. [Online]. Available: <http://www.tariktosun.com/wp-content/uploads/tosun2014general.pdf>.
- [9] I. OHara, J. Paulos, J. Davey, N. Eckenstein, N. Doshi, T. Tosun, J. Greco, J. Seo, M. Turpin, V. Kumar, and M. Yim, “Self-assembly of a swarm of autonomous boats into floating structures,” in *IEEE International Conference on Robotics and Automation*, 2014,

pp. 1234–1240. [Online]. Available: <http://www.tariktosun.com/wp-content/uploads/ohara2014self.pdf>, **Best Systems Paper Award Winner**.

Invited Talks

- March 27, 2018 **“Reconfigurable Robots: Systems that Transform Themselves and Their Environments”**, *Faculty Candidate Seminar, Carnegie Mellon University Mechanical Engineering Department, Pittsburgh, PA.*
- May 29, 2017 **“PaintPots: Low cost, Accurate, Highly Customizable Potentiometers for Position Sensing”**, *2017 IEEE International Conference on Robotics and Automation, Singapore, Singapore.*
- Oct 10, 2016 **“Design and Characterization of the EP-Face Connector”**, *2017 IEEE International Conference on Intelligent Robots and Systems, Daejeon, Korea.*
- Aug 16, 2016 **“Addressing Tasks with Modular Robots”**, *MEAM Department Ph.D Seminar, University of Pennsylvania, Philadelphia, PA.*
- Sept 15, 2015 **“Self-Assembly of a Swarm of Autonomous Boats into Floating Structures”**, *2015 International Symposium on Robotics Research, Sestri Levante, Italy.*
- Sept 12, 2015 **“Computer-Aided Compositional Design and Verification for Modular Robots”**, *2015 International Symposium on Robotics Research, Sestri Levante, Italy.*
- Nov 17, 2014 **“A General Method For Kinematic Retargeting”**, *2014 ASME International Mechanical Engineering Congress and Exposition, Montreal, Quebec, Canada.*

Service and Outreach

2012–2018 **Tour Guide**, *GRASP Laboratory, University of Pennsylvania.*

2012–**Ad-hoc Reviewer**, IEEE Robotics and Automation Letters, Autonomous
Present Robots, Robotics: Science and Systems, IEEE International Conference on Robotics and Automation, IEEE International Conference on Robots and Systems, ASME International Mechanical Engineering Congress and Exposition.

Robotic Art

Dec 2014 **Orpheus and Euridice: Electromechanical Redux**, *Slought Foundation, Philadelphia, PA.*

- Collaborated with faculty and students from PennDesign and PennEngineering as well as members of the Philadelphia Opera and Curtis Institute of Music to develop a modern, mechatronic retelling of the classic opera. The performance featured professional opera singers and musicians interacting with electromechanical devices to tell the story of Orpheus and Euridice.
- More information: <https://www.design.upenn.edu/architecture/graduate/events/orpheus-and-eurydice-electromechanical-redux>
- Video: <https://vimeo.com/117352236>