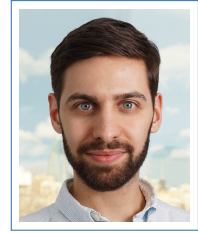


# Tarik Tosun

Samsung AI Center New York  
123 W 18th Street  
New York, NY, 10011  
☎ (302) 547 4196  
✉ [tarik@seas.upenn.edu](mailto:tarik@seas.upenn.edu)  
🌐 [www.tariktosun.com](http://www.tariktosun.com)



## Research Interests

My research focuses on two kinds adaptive robots. *Modular self-reconfigurable robots* (MSRR) adapt to the requirements of their task and environment by transforming themselves. By rearranging the connective structure of their component robot modules, these systems can assume different morphologies: for example, a cluster of modules might configure themselves into a car to maneuver on flat ground, a snake to climb stairs, or an arm to pick and place objects. Conversely, *environment augmentation* is a strategy in which a robot transforms its environment to suit its own capabilities, adding physical structures that let it overcome obstacles. In both areas, my work includes elements of hardware design, algorithms, and theoretical frameworks to enable adaptive robots to address complex high-level tasks.

## 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

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## 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.

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## 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)

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

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## Refereed Conference Papers

- [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**.

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## 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.*

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## Service and Outreach

- 2012–2018 **Tour Guide**, *GRASP Laboratory, University of Pennsylvania.*
- 2012– Present **Ad-hoc Reviewer**, *IEEE Robotics and Automation Letters, Autonomous 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.*

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## 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>