

# Michael T. Tolley

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## Research Interests and Experience

- Bioinspired, soft, & origami robotics
- Microfabrication & microfluidics
- Self-assembly & microassembly
- Simulation & controls
- Programming Languages: C++, C, Java, Fortran, Turbo Pascal
- Engineering Software: Matlab, SolidWorks, Maple, Labview

## Education

- 08/2005 - 08/2010     **M.S./Ph.D. Mechanical Engineering**  
*Cornell University, Ithaca NY*  
Dissertation: Programmable stochastic fluidic assembly of  
microscale components  
Advisor: Prof. Hod Lipson
- 09/2000 - 06/2005     **B. Eng. Mechanical Engineering (Honours)**  
*McGill University, Montreal QC*  
Honours Thesis: Behaviour development for a hybrid  
quadrupedal robot  
Advisor: Prof. Inna Sharf

## Research and Work Experience

- 02/2011 - Present     **Postdoctoral Associate**  
*Harvard Microrobotics Lab, Wyss Institute for Biologically  
Inspired Engineering, Harvard University*  
Supervisor: Prof. Robert Wood  
Project: Printable robots and soft robotics
- 08/2010 – 02/2011     **Postdoctoral Associate**  
*Computational Synthesis Lab, Cornell University*  
Supervisor: Prof. Hod Lipson  
Project: 3-D Stochastic Fluidic Assembly

- 04/2004 - 07/2005     **Research Assistant**  
*Centre for Intelligent Machines, McGill University*  
Supervisor: Prof. Inna Sharf  
Responsibilities: Design, ordering, construction, and programming of legged robots
- 09/2004 - 04/2005     **Mechanical Engineering Tutor**  
*ACE Tutorials, McGill University*  
Responsibilities: Weekly tutorial hours and pre-exam seminars for first and second year engineering students
- 09/2001 - 08/2004     **Mechanical Engineer**  
*Team iSun Solar Car Project, McGill University*  
Responsibilities: Design, fabrication, wind tunnel testing, maintenance of solar car mechanical systems, fundraising

## Teaching Experience

- 11/2011                 **Guest Lecturer, Computer-Aided Machine Design (ES51)**  
*Harvard University*  
Topic: Linkage Synthesis
- 08/2005 - 12/2006     **Teaching Assistant, Applied Systems Engineering (SYSEN 510)**  
*Systems Engineering, Cornell University*  
Supervisors: Profs. Peter L. Jackson and Mason Peck  
Responsibilities: Office hours, supervising assignment graders, grading exams, point-of-contact for 60 on-campus and 20 off-campus students
- 01/2006 - 05/2006     **Teaching Assistant, System Dynamics (MAE 326)**  
*Sibley School of Mechanical and Aerospace Engineering, Cornell University*  
Supervisor: Prof. Mark Psiaki  
Responsibilities: Recitations, office hours, grading, point-of-contact for 80 students

## Honours and Awards

- 05/2007     **Natural Sciences and Engineering Research Council of Canada (NSERC) Postgraduate Scholarship – Doctoral (\$63,000 over three years)**  
For academic excellence, research ability or potential, and communication, interpersonal, and leadership abilities

- 05/2006 **NSERC Postgraduate Scholarship – Masters (\$17,300)**  
For academic excellence, research ability or potential, and communication, interpersonal, and leadership abilities
- 05/2005 **NSERC Undergraduate Student Research Award (\$7,000)**  
For academic excellence and research aptitude
- 05/2005 **Dean’s Honour List, Faculty of Engineering, McGill University**  
For a CGPA within the top 10% of graduating students in the Faculty of Engineering
- 09/2004 **David E. & Ronnie Schouela Scholarship, McGill University (\$1000)**  
For academic performance in the Honours Mechanical Engineering program at McGill University
- 05/2004 **NSERC Undergraduate Student Research Award (\$5,625)**  
For academic excellence and research aptitude
- 07/2003 **9<sup>th</sup> Place & Best Rookie Team Award, American Solar Challenge 2003**  
Solar-powered car race from Chicago, IL to Las Angeles, CA
- 03/2002 **1st Place, Team Design Category (\$1500)**  
Canadian Engineering Competition
- 02/2002 **1st Place, Team Design Category (\$1000)**  
Quebec Engineering Competition
- 01/2002 **1st Place, Team Design Category (\$400)**  
McGill Engineering Competition
- 09/2000 **J. W. McConnell Scholarship, McGill University (\$20,000 over four years)**  
For academic standing and community and school leadership

## **Publications**

### ***Refereed Journal Publications***

1. **Tolley M. T., Lipson H. (2011) "[On-line Assembly Planning for Stochastically Reconfigurable Systems](#)", [International Journal of Robotics Research](#), 30:13, pp. 1566 - 1584.**

2. Kalontarov M., **Tolley M. T.**, Lipson H., Erickson D. (2010) "[Hydrodynamically Driven Docking of Blocks for 3D Fluidic Assembly](#)", [Microfluidics and Nanofluidics](#), 9, pp. 551–558.
3. **Tolley M. T.**, Kalontarov M., Neubert J., Erickson D., Lipson H. (2010) "[Stochastic Modular Robotic Systems: A Study of Fluidic Assembly Strategies](#)", [IEEE Transactions on Robotics](#), 26, pp. 518-530.
4. Krishnan M., **Tolley M. T.**, Lipson H., Erickson D. (2009) "[Hydrodynamically Tunable Fluidic Affinities for Fluidic Assembly](#)", [Langmuir](#), 25, pp. 3769-3774.
5. **Tolley M. T.**, Krishnan M., Erickson D., Lipson H. (2008) "[Dynamically Programmable Fluidic Assembly](#)", [Applied Physics Letters](#), 93, 254105. *\*\*Also appeared in [Virtual Journal of Nanoscale Science & Technology](#), vol. 19, 2\*\**
6. Krishnan M., **Tolley M. T.**, Lipson H., Erickson D. (2008) "[Increased Robustness for Fluidic Self Assembly](#)", [Physics of Fluids](#), 20, 073304. *\*\*Also appeared in [Virtual Journal of Nanoscale Science & Technology](#), vol. 18, 5\*\**

### **Refereed Conference Publications**

7. **Tolley, M. T.**, Lipson, H., (2011) "[Programmable 3D Stochastic Fluidic Assembly of cm-Scale Modules](#)", IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2011), September 2011, pp. 4366-4371.
8. **Tolley, M. T.**, Lipson, H., (2010) "Three Dimensional Stochastic Fluidic Assembly of Minimalistic Modules", Proc. McGill Centre for Intelligent Machines Symp. on Brain, Body, and Machine, Montreal QC, November 2010, pp. 2473-2478.
9. **Tolley, M. T.**, Lipson, H., (2010) "[Fluidic Manipulation for Scalable Stochastic 3D Assembly of Modular Robots](#)", Proc. Int. Conf. on Robotics and Automation (ICRA), Anchorage AK, May 2010, pp. 2473-2478.
10. **Tolley, M. T.**, Hiller, J., Lipson, H., (2009) "[Evolutionary Design and Assembly Planning for Stochastic Modular Robots](#)", Proc. Int. Conf. on Intelligent Robots and Systems (IROS), Exploring New Horizons in Evolutionary Design of Robots Workshop, St. Louis MO, October 2009, pp. 73-78.
11. **Tolley M. T.**, Erickson D., Lipson H. (2009) "Fluidic Assembly of Programmable Matter", Cornell Engineering Research Conference (CERC), Ithaca NY, April 2009.
12. Krishnan M., **Tolley M. T.**, Lipson H., Erickson D. (2008) "Dynamically Tunable Affinities for Fluidic Self Assembly", Am. Inst. of Chem. Engineers (AIChE) Annual Meeting, Philadelphia PA, November 2008, 485e.

13. **Tolley M. T.**, Krishnan M., Lipson H., Erickson D. (2008) "[Advances Towards Programmable Matter](#)", Proc. Int. Conf. Miniaturized Systems for Chemistry and Life Sciences (MicroTAS), San Diego CA, October 2008, pp. 653-655.
14. Chung M., Malone E., **Tolley M. T.**, Chepaitis A. J., Lipson H., (2008) "[Object Augmentation for the Visually Impaired Using RP](#)", Proc. Solid Freeform Fabrication (SFF) Symp., Austin TX, August 2008.
15. **Tolley M. T.**, Baisch A., Krishnan M., Erickson D., Lipson H., (2008) "[Interfacing Methods for Fluidically-Assembled Microcomponents](#)", Proc. IEEE Int. Conf. Micro Electro Mechanical Systems (MEMS), Tucson AZ, January 2008, pp. 1073-1076.
16. Krishnan M., **Tolley M. T.**, Lipson H., Erickson D., (2007) "[Directed Hierarchical Self Assembly - Active Fluid Mechanics at the Micro and Nanoscales](#)", Proc. ASME Int. Mechanical Engineering Cong. and Expo. (IMECE), Seattle WA, November 2007. \* **Winner of Best Presentation award** \*
17. **Tolley M. T.**, Zykov V., Lipson H., Erickson D., (2006) "[Directed Fluidic Self-Assembly of Microscale Tiles](#)", Proc. Int. Conf. Miniaturized Systems for Chemistry and Life Sciences (MicroTAS), Tokyo Japan, October 2006, pp. 1552-1554.

### **Other Conference Papers**

18. **Tolley M. T.**, Krishnan M., Erickson D., Lipson H. (2008) "Approaches to dynamically programmable self-assembly", *Proc. of Foundations of Nanoscience (FNANO)*, Snowbird, UT, April 2008.

### **Dissertations**

19. **Tolley M. T.**, (2010) "Programmable Stochastic Assembly of Microscale Components", *Doctoral Dissertation*, Cornell University, Ithaca, USA.

### **Book Chapters**

20. **Tolley M. T.**, Hiller J. and Lipson H. (2010) "Evolutionary Design and Assembly Planning for Stochastic Modular Robots," in Bredeche N., Doncieux S. and Mouret J.-B. (Eds.), *New Horizons in Evolutionary Robotics: post-proceedings of the 2010 EvoDeRob workshop* (in press). Berlin, Germany: Springer.

### **Colloquia Talks**

1. Dynamics, Systems and Controls Seminar, Cornell University, "Deterministic Non-Regular Microstructures from Regular Components", September 2007.

2. SIGMA Student Seminar Series, Cornell University, "Directed Fluidic Assembly of Microscale Tiles", November 2006.
3. Dynamics, Systems and Controls Seminar, Cornell University, "Programmable Micro-scale Fluidic Self-Assembly", March 2006.

## **Art Exhibitions**

Stochastic fluidic assembly work featured in "[Digital Matter](#)" by Joris Laarman, "Modern by design" exhibition, High Museum of Art, Atlanta, GA, June-August 2011.

## **Press and Media Coverage**

Robots Podcast: [Programmable Matter](#), August 27, 2010.

## **Professional Activities**

### ***Membership***

IEEE (Institute of Electrical and Electronics Engineers), since 2009.

### ***Conference Organization***

Session Chair, Cornell Engineering Research Conference, Cornell University, April 2010.

### ***Reviewing***

1. IEEE Transactions on Robotics (T-RO)
2. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
3. Robotica
4. IEEE International Conference on Robotics and Automation (ICRA)
5. International Conference on the Simulation and Synthesis of Living Systems (ALIFE)
6. IEEE Transactions on Automation Science and Engineering
7. Rapid Prototyping Journal
8. Proceedings of the IEEE

## Leadership and Project Management

- 08/2007 - 04/2008     **Advisor for Undergraduate Student Research**  
*Cornell University*  
Student: Marilyn Chung  
Project: Object Augmentation for the Visually Impaired Using Rapid Prototyping
- 09/2006 - 12/2007     **Intramural Team Captain, Ice Hockey**  
*Cornell University*
- 05/2006 - 08/2007     **Mentor, Cornell Nanofabrication Facility (CNF) Research Experience for Undergraduates (REU) Summer Program**  
*Cornell University*  
REU Students:
- Suraj Kabadi (Advanced Fabrication of Electroactive Nanowell Sensors, 2006)
  - Andrew Baisch (Patterning of Electrical Circuits on Fluidic Assembly Microtiles, 2007)
- 09/2003 - 04/2005     **Student Society Representative**  
*Engineering Undergraduate Society (EUS) and Student Society of McGill University (SSMU)*
- Represented engineering students with voting rights on both councils, and multiple committees
- 01/2002 - 04/2005     **Engineering Competition Team Leader**  
*McGill University*
- Organized team of four engineering students to compete at annual engineering competitions and the school, provincial and national levels
- 09/2000 - 04/2005     **Team Captain, Intermural Ultimate Frisbee and Innertube Waterpolo**  
*McGill University*
- Led Ultimate Frisbee team to win Division A championships in 2003 and 2004
- 09/2002 - 04/2003     **Volunteer Peer Tutor**  
*Science Undergraduate Society, McGill University*
- Tutored first year science students in physics and calculus