

# TIMOTHY BRETL

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## Research Interests

Theoretical and algorithmic foundations of robotics and automation. Motion planning, control, optimization.

## Employment

- 2016-present Associate Head of Aerospace Engineering, University of Illinois at Urbana-Champaign
- 2013-present Associate Professor of Aerospace Engineering, University of Illinois at Urbana-Champaign (with affiliate appointments in the Coordinated Science Laboratory, the Department of Computer Science, the Department of Electrical and Computer Engineering, the Neuroscience Program, and the Beckman Institute for Advanced Science and Technology).
- 2015-2016 Chief Innovation Officer and Secretary, Reconstruct Inc, Champaign, IL.
- 2013 Visiting Researcher, LAAS-CNRS, Toulouse, France.
- 2006-2013 Assistant Professor of Aerospace Engineering, University of Illinois at Urbana-Champaign.
- 2005-2006 Postdoctoral Research Affiliate. Computer Science Department, Stanford University (Advisor: Jean-Claude Latombe).

## Education

- 1999-2005 M.S. / Ph.D., Aeronautics and Astronautics, Stanford University (Thesis: “Multi-Step Motion Planning: Application to Free-Climbing Robots”; Advisor: Stephen M. Rock).
- 1995-1999 B.S., Engineering / B.S., Mathematics, Swarthmore College.

## PhD Students

- May 2017 Dr. Aadeel Akhtar. Neuroscience Program, University of Illinois at Urbana-Champaign (Thesis: “Mechanisms for enabling closed-loop upper limb sensorimotor prosthetic control”).
- August 2015 Dr. Dennis Matthews. Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign (Thesis: “Experiments in quasi-static manipulation of an elastic rod”).
- May 2015 Dr. Navid Aghasadeghi. Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign (Thesis: “Inverse optimal control for differentially flat systems with application to lower-limb prosthetic devices”).
- December 2013 Dr. Miles Johnson. Department of Aerospace Engineering, University of Illinois at Urbana-Champaign (Thesis: “Inverse Optimal Control for Deterministic Nonlinear Systems”).

- May 2013 Dr. Abdullah Akce. Department of Computer Science, University of Illinois at Urbana-Champaign (Thesis: "Human Control of Robots Over Discrete Noisy Channels with High Latency: Toward Efficient EEG-Based Brain-Robot Interfaces").
- August 2012 Dr. Aaron Becker, Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign (Thesis: Ensemble Control of Robotic Systems).

## Honors and Awards

- 2016 *Rose Award for Teaching Excellence*. College of Engineering, University of Illinois at Urbana-Champaign.  
*William L. Everett Award for Teaching Excellence*. College of Engineering, University of Illinois at Urbana-Champaign.  
*List of Teachers Ranked as Excellent by Their Students (AE483: UAV Navigation and Control, Fall Semester)*. University of Illinois at Urbana-Champaign.
- 2015 *Collins Award for Innovative Teaching*. College of Engineering, University of Illinois at Urbana-Champaign.  
*AIAA Teacher of the Year Award*. AIAA Student Chapter, University of Illinois at Urbana-Champaign.  
*List of Teachers Ranked as Excellent by Their Students (AE352: Aerospace Dynamic Systems, Spring Semester)*. University of Illinois at Urbana-Champaign.  
*List of Teachers Ranked as Excellent by Their Students (AE353: Aerospace Control Systems, Spring Semester)*, **with outstanding ratings**. University of Illinois at Urbana-Champaign.
- 2014 *List of Teachers Ranked as Excellent by Their Students (AE483: Aerospace Decision Algorithms, Fall Semester)*, **with outstanding ratings**. University of Illinois at Urbana-Champaign.  
*List of Teachers Ranked as Excellent by Their Students (AE353: Aerospace Control Systems, Spring Semester)*, **with outstanding ratings**. University of Illinois at Urbana-Champaign.  
*Finalist, Best Paper Award (for "State estimation and tracking of deforming planar elastic rods," with Andy Borum and Dennis Matthews)*. IEEE International Conference on Robotics and Automation.
- 2013 *AIAA Teacher of the Year Award*. AIAA Student Chapter, University of Illinois at Urbana-Champaign.
- 2012 *Finalist, ICROS Best Application Paper Award (for "Experiments in Quasi-Static Manipulation of a Planar Elastic Rod," with Dennis Matthews)*. IEEE/RSJ International Conference on Intelligent Robotics and Systems.  
*Best Manipulation Paper Award (for "Mechanics and Manipulation of Planar Elastic Kinematic Chains," with Zoe McCarthy)*. IEEE International Conference on Robotics and Automation.  
*List of Teachers Ranked as Excellent by Their Students (AE483: Aerospace Decision Algorithms, Fall Semester)*, **with outstanding ratings**. University of Illinois at Urbana-Champaign.  
*List of Teachers Ranked as Excellent by Their Students (ECE470: Introduction to Robotics, Fall Semester)*. University of Illinois at Urbana-Champaign.  
*List of Teachers Ranked as Excellent by Their Students (AE403: Spacecraft Attitude Control, Spring Semester)*. University of Illinois at Urbana-Champaign.
- 2011 *Engineering Council award for Excellence in Advising*. University of Illinois at Urbana-Champaign.
- 2010 *CAREER Award*. National Science Foundation.  
*List of Teachers Ranked as Excellent by Their Students (AE403: Spacecraft Attitude Control, Spring Semester)*. University of Illinois at Urbana-Champaign.

- 2009 *List of Teachers Ranked as Excellent by Their Students (ECE550: Advanced Robotic Planning, Spring Semester)*. University of Illinois at Urbana-Champaign.
- 2008 *List of Teachers Ranked as Excellent by Their Students (AE403: Spacecraft Attitude Control, Spring Semester)*. University of Illinois at Urbana-Champaign.

## **Instruction**

### **Courses Taught**

- 2017 AE353 (Aerospace Control Systems, Spring Semester).
- 2016 AE483 (UAV Navigation and Control, Fall Semester).  
AE598 (Field Robotics, Spring Semester).
- 2015 AE352 (Aerospace Dynamic Systems, Fall Semester).  
AE353 (Aerospace Control Systems, Spring Semester).
- 2014 AE483 (Aerospace Decision Algorithms, Fall Semester).  
AE353 (Aerospace Control Systems, Spring Semester).
- 2013 AE482 (Introduction to Robotics, Spring Semester) — taught at Danville Correctional Center as part of the Education Justice Project.  
ECE550 (Advanced Robotic Planning, Spring Semester) — co-taught with Seth Hutchinson.
- 2012 ECE470 (Introduction to Robotics, Fall Semester).  
AE483 (Aerospace Decision Algorithms, Fall Semester).  
AE403 (Spacecraft Attitude Control, Spring Semester).
- 2011 AE483 (Aerospace Decision Algorithms, Fall Semester) — co-taught with Cedric Langbort.  
ECE550 (Advanced Robotic Planning, Spring Semester) — co-taught with Seth Hutchinson.  
AE483 (Aerospace Decision Algorithms, Spring Semester) — co-taught with Cedric Langbort.
- 2010 AE100SD (Introduction to Aerospace Engineering: Spacecraft Design, Fall Semester).  
AE590 (Aerospace Graduate Seminar, Fall Semester).  
AE403 (Spacecraft Attitude Control, Spring Semester).
- 2009 ECE470 (Introduction to Robotics, Fall Semester).  
ECE550 (Advanced Robotic Planning, Spring Semester) — co-taught with Seth Hutchinson.  
AE252 (Introduction to Aerospace Dynamics, Spring Semester).
- 2008 AE498MPA (Intelligent Mobile Navigation, Fall Semester).  
AE403 (Spacecraft Attitude Control, Spring Semester).
- 2007 AE498MPA (Intelligent Mobile Navigation, Fall Semester).  
AE252 (Introduction to Aerospace Dynamics, Spring Semester).
- 2006 AE498MPA (Motion Planning for Aerospace Vehicles, Fall Semester).

### **Courses Developed**

- 2011 AE483 (Aerospace Decision Algorithms), an undergraduate course in aerospace robotics, developed as part of a major curriculum revision for Aerospace Engineering. With Cedric Langbort. Origins in the special topics course AE498MPA (Motion Planning for Aerospace Vehicles).

## Publications

### Journal Publications

- [J25] A. Akhtar, N. Aghasadeghi, L. Hargrove, and T. Bretl, “Estimation of distal arm joint angles from emg and shoulder orientation for transhumeral prostheses,” *Journal of Electromyography and Kinesiology*, vol. 35, pp. 86–94, Aug. 2017.
- [J24] J. J. S. Norton, S. Umunna, and T. Bretl, “The elicitation of steady-state visual evoked potentials during sleep,” *Psychophysiology*, vol. 54, no. 4, pp. 496–507, 2017.
- [J23] A. Borum and T. Bretl, “Reduction of sufficient conditions for optimal control problems with subgroup symmetry,” *IEEE Transactions on Automatic Control*, vol. 62, no. 7, pp. 3209–3224, Jul. 2016.
- [J22] A. Borum and T. Bretl, “Sufficient conditions for a path-connected set of local solutions to an optimal control problem,” *SIAM Journal on Applied Mathematics*, vol. 76, no. 3, pp. 976–999, 2016.
- [J21] “Epidermal mechano-acoustic sensing electronics for cardiovascular diagnostics and human-machine interfaces,” *Science Advances*, vol. 2, no. 11, 2016. eprint: <http://advances.sciencemag.org/content/2/11/e1601185.full.pdf>.
- [J20] B. Xu, A. Akhtar, Y. Liu, H. Chen, W.-H. Yeo, S. I. Park, B. Boyce, H. Kim, J. Yu, H.-Y. Lai, S. Jung, Y. Zhou, J. Kim, S. Cho, Y. Huang, T. Bretl, and J. A. Rogers, “An epidermal stimulation and sensing platform for sensorimotor prosthetic control, management of lower back exertion, and electrical muscle activation,” *Advanced Materials*, vol. 28, no. 22, pp. 4462–4471, 2016.
- [J19] A. Akce, J. Norton, and T. Bretl, “An ssvep-based brain-computer interface for text spelling with adaptive queries that maximize information gain rates,” *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 23, no. 5, pp. 857–866, 2015.
- [J18] J. J. S. Norton, D. S. Lee, J. W. Lee, W. Lee, O. Kwon, P. Won, S.-Y. Jung, H. Cheng, J.-W. Jeong, A. Akce, S. Umunna, I. Na, Y. H. Kwon, X.-Q. Wang, Z. Liu, U. Paik, Y. Huang, T. Bretl, W.-H. Yeo, and J. A. Rogers, “Soft, curved electrode systems capable of integration on the auricle as a persistent brain–computer interface,” *Proceedings of the National Academy of Sciences*, vol. 112, no. 13, pp. 3920–3925, 2015.
- [J17] A. Becker, C. Onyuksel, T. Bretl, and J. McLurkin, “Controlling many differential-drive robots with uniform control inputs,” *International Journal of Robotics Research*, vol. 33, no. 13, pp. 1626–1644, 2014.
- [J16] T. Bretl and Z. McCarthy, “Quasi-static manipulation of a kirchhoff elastic rod based on a geometric analysis of equilibrium configurations,” *International Journal of Robotics Research*, vol. 33, no. 1, pp. 48–68, 2014.
- [J15] M. W. Kennedy, T. Bretl, and J. P. Schmiedeler, “Interpreting lateral dynamic weight shifts using a simple inverted pendulum model,” *Gait & Posture*, vol. 40, no. 1, pp. 134–139, 2014.
- [J14] A. Akce, M. Johnson, O. Dantsker, and T. Bretl, “A brain-machine interface to navigate a mobile robot in a planar workspace: Enabling humans to fly simulated aircraft with eeg,” *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 21, no. 2, pp. 306–318, Mar. 2013.
- [J13] T. Bretl and Z. McCarthy, “Mechanics and quasi-static manipulation of planar elastic kinematic chains,” *IEEE Transactions on Robotics*, vol. 29, no. 1, pp. 1–14, 2013.
- [J12] J.-W. Jeong, W.-H. Yeo, A. Akhtar, J. J. S. Norton, Y.-J. Kwack, S. Li, S.-Y. Jung, Y. Su, W. Lee, J. Xia, H. Cheng, Y. Huang, W.-S. Choi, T. Bretl, and J. A. Rogers, “Materials and optimized designs for human-machine interfaces via epidermal electronics,” *Advanced Materials*, vol. 25, no. 47, pp. 6839–6846, 2013.
- [J11] A. Becker and T. Bretl, “Approximate steering of a unicycle under bounded model perturbation using ensemble control,” *IEEE Transactions on Robotics*, vol. 28, no. 3, pp. 580–591, 2012.
- [J10] T. Bretl, “Minimum-time optimal control of many robots that move in the same direction at different speeds,” *IEEE Transactions on Robotics*, vol. 28, no. 2, pp. 351–363, Apr. 2012.
- [J9] R. D. Gregg, A. K. Tilton, S. Candido, T. Bretl, and M. W. Spong, “Control and planning of 3-D dynamic walking with asymptotically stable gait primitives,” *IEEE Transactions on Robotics*, vol. 28, no. 6, pp. 1415–1423, 2012.

- [J8] R. Ma, N. Aghasadeghi, J. Jarzebowski, T. Bretl, and T. Coleman, “A stochastic control approach to optimally designing hierarchical flash sets in p300 communication prostheses,” *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 20, no. 1, pp. 102–112, Jan. 2012.
- [J7] K. A. Shorter, Y. Li, T. Bretl, and E. T. Hsiao-Wecksler, “Modeling, control, and analysis of a robotic assist device,” *Mechatronics*, vol. 22, no. 8, pp. 1067–1077, 2012.
- [J6] Y. Li, A. Becker, K. A. Shorter, T. Bretl, and E. Hsiao-Wecksler, “Estimating system state during gait with a limited sensor array on a powered ankle-foot orthosis,” *IEEE/ASME Transactions on Mechatronics*, vol. 16, no. 5, Oct. 2011.
- [J5] C. Omar, A. Akce, M. Johnson, T. Bretl, R. Ma, E. Maclin, M. McCormick, and T. Coleman, “A feedback information-theoretic approach to the design of brain-computer interfaces,” *International Journal of Human-Computer Interaction*, vol. 27, no. 1, pp. 5–23, 2011.
- [J4] T. Bretl, G. Arechavaleta, A. Akce, and J.-P. Laumond, “Comments on ‘an optimality principle governing human walking’,” *IEEE Transactions on Robotics*, vol. 26, no. 6, pp. 1105–1006, 2010.
- [J3] T. Bretl and S. Lall, “Testing static equilibrium for legged robots,” *IEEE Transactions on Robotics*, vol. 24, no. 4, pp. 794–807, Aug. 2008.
- [J2] K. Hauser, T. Bretl, J.-C. Latombe, K. Harada, and B. Wilcox, “Motion planning for legged robots on varied terrain,” *International Journal of Robotics Research*, vol. 27, no. 11-12, pp. 1325–1349, Nov. 2008.
- [J1] T. Bretl, “Motion planning of multi-limbed robots subject to equilibrium constraints: The free-climbing robot problem,” *International Journal of Robotics Research*, vol. 25, no. 4, pp. 317–342, 2006.

### Conference Publications

- [C73] K.-Y. Choi, A. Akhtar, and T. Bretl, “A compliant four-bar linkage mechanism that makes the fingers of a prosthetic hand more impact resistant,” in *IEEE International Conference on Robotics and Automation*, 2017.
- [C72] A. Akhtar, K. Y. Choi, M. Fatina, J. Cornman, E. Wu, J. Sombeck, C. Yim, P. Slade, J. Lee, J. Moore, D. Gonzales, A. Wu, G. Anderson, D. Rotter, C. Shin, and T. Bretl, “A low-cost, open-source, compliant hand for enabling sensorimotor control for people with transradial amputations,” in *International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, Aug. 2016, pp. 4642–4645.
- [C71] A. Borum and T. Bretl, “Helices, relative equilibria, and optimality on the special euclidean group,” in *IEEE Conference on Decision and Control (CDC)*, Dec. 2016, pp. 185–190.
- [C70] J. DeGol, A. Akhtar, B. Manja, and T. Bretl, “Automatic grasp selection using a camera in a hand prosthesis,” in *International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, Aug. 2016, pp. 431–434.
- [C69] D. J. Hanley and T. Bretl, “An improved model-based observer for inertial navigation for quadrotors with low cost imu,” in *AIAA Guidance, Navigation, and Control Conference*, 2016, p. 0105.
- [C68] A. Borum and T. Bretl, “The free configuration space of a kirchhoff elastic rod is path-connected,” in *IEEE International Conference on Robotics and Automation*, Seattle, WA, May 2015, pp. 2958–2964.
- [C67] J. DeGol, D. Hanley, N. Aghasadeghi, and T. Bretl, “A passive mechanism for relocating payloads with a quadrotor,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Sep. 2015, pp. 4337–4342.
- [C66] O. Roussel, A. Borum, M. Taix, and T. Bretl, “Manipulation planning with contacts for an extensible elastic rod by sampling on the submanifold of static equilibrium configurations,” in *IEEE International Conference on Robotics and Automation*, Seattle, WA, May 2015, pp. 3116–3121.
- [C65] P. Slade, A. Akhtar, M. Nguyen, and T. Bretl, “Tact: Design and performance of an open-source, affordable, myoelectric prosthetic hand,” in *IEEE International Conference on Robotics and Automation*, Seattle, WA, May 2015, pp. 6451–6456.
- [C64] N. Aghasadeghi and T. Bretl, “Inverse optimal control for differentially flat systems with application to locomotion modeling,” in *IEEE International Conference on Robotics and Automation (ICRA)*, Hong Kong, Jun. 2014.

- [C63] A. Akhtar, B. Boyce, and T. Bretl, “The relationship between energy, phase charge, impedance, and perceived sensation in electro-tactile stimulation,” in *IEEE Haptics Symposium (HAPTICS)*, Feb. 2014, pp. 69–74.
- [C62] A. Akhtar, J. Norton, M. Kasraie, and T. Bretl, “Playing checkers with your mind: An interactive multiplayer hardware game platform for brain-computer interfaces,” in *International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, Chicago, IL, Aug. 2014, pp. 1650–1653.
- [C61] A. Akhtar, M. Nguyen, L. Wan, B. Boyce, P. Slade, and T. Bretl, “Passive mechanical skin stretch for proprioception in a hand prosthesis,” in *EuroHaptics*, Versailles, France, Jun. 2014.
- [C60] A. Borum and T. Bretl, “Geometric optimal control for symmetry breaking cost functions,” in *IEEE Conference on Decision and Control (CDC)*, Los Angeles, CA, Dec. 2014.
- [C59] A. Borum, D. Matthews, and T. Bretl, “State estimation and tracking of deforming planar elastic rods,” in *IEEE International Conference on Robotics and Automation (ICRA)*, Hong Kong, Jun. 2014.
- [C58] P. Geoffroy, O. Bordron, N. Mansard, M. Raison, O. Stasse, and T. Bretl, “A two-stage suboptimal approximation for variable compliance and torque control,” in *European Control Conference (ECC)*, Jun. 2014, pp. 1151–1157.
- [C57] M. Mukadam, A. Borum, and T. Bretl, “Quasi-static manipulation of a planar elastic rod using multiple robotic grippers,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Chicago, IL, Sep. 2014, pp. 55–60.
- [C56] O. Roussel, M. Taix, and T. Bretl, “Efficient motion planning for quasi-static elastic rods using geometry neighborhood approximation,” in *IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, Besançon, France, Jul. 2014, pp. 1024–1029.
- [C55] N. Aghasadeghi, H. Zhao, L. Hargrove, A. Ames, E. Perreault, and T. Bretl, “Learning impedance controller parameters for lower-limb prostheses,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Nov. 2013, pp. 4268–4274.
- [C54] H. Awni, J. Norton, S. Umunna, K. Federmeier, and T. Bretl, “Towards a brain computer interface based on the n2pc event-related potential,” in *IEEE/EMBS International Conference on Neural Engineering (NER)*, Nov. 2013, pp. 1021–1024.
- [C53] T. Bretl and S. Hutchinson, “Robust coverage by a mobile robot of a planar workspace,” in *IEEE International Conference on Robotics and Automation*, Karlsruhe, Germany, May 2013.
- [C52] E. C. Johnson, J. J. S. Norton, D. Jun, T. Bretl, and D. L. Jones, “Sequential selection of window length for improved ssvp-based bci classification,” in *Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2013, pp. 7060–7063.
- [C51] M. Johnson, N. Aghasadeghi, and T. Bretl, “Inverse optimal control for deterministic continuous-time nonlinear systems,” in *IEEE Conference on Decision and Control (CDC)*, Dec. 2013, pp. 2906–2913.
- [C50] N. Aghasadeghi, A. Long, and T. Bretl, “Inverse optimal control for a hybrid dynamical system with impacts,” in *IEEE International Conference on Robotics and Automation (ICRA)*, St. Paul, MN, May 2012.
- [C49] A. Akce, J. Norton, and T. Bretl, “A brain-machine interface to navigate mobile robots along human-like paths amidst obstacles,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2012.
- [C48] A. Akhtar, L. J. Hargrove, and T. Bretl, “Prediction of distal arm joint angles from emg and shoulder orientation for prosthesis control,” in *Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, Aug. 2012, pp. 4160–4163.
- [C47] A. Becker and T. Bretl, “Approximate steering of a plate-ball system under bounded model perturbation using ensemble control,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2012, pp. 5353–5359.
- [C46] A. Becker, C. Onyuksel, and T. Bretl, “Feedback control of many differential-drive robots with uniform control inputs,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2012.
- [C45] D. Bonnie, S. Candido, T. Bretl, and S. Hutchinson, “Modelling search with a binary sensor utilizing self-conjugacy of the exponential family,” in *IEEE International Conference on Robotics and Automation (ICRA)*, May 2012, pp. 3975–3982.

- [C44] T. Bretl and Z. McCarthy, “Equilibrium configurations of a Kirchhoff elastic rod under quasi-static manipulation,” in *Workshop on the Algorithmic Foundations of Robotics (WAFR)*, Boston, MA, Jun. 2012.
- [C43] O. Dantsker, M. Johnson, A. Akce, and T. Bretl, “Development of a fixed wing multi-role unmanned aircraft vehicle research testbed,” in *AIAA Aerospace Sciences Meeting*, Jan. 2012.
- [C42] S. Hutchinson and T. Bretl, “Robust optimal deployment of mobile sensor networks,” in *IEEE International Conference on Robotics and Automation (ICRA)*, May 2012.
- [C41] D. Matthews and T. Bretl, “Experiments in quasi-static manipulation of a planar elastic rod,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2012.
- [C40] Z. McCarthy, T. Bretl, and S. Hutchinson, “Proving path non-existence using sampling and alpha shapes,” in *IEEE International Conference on Robotics and Automation (ICRA)*, May 2012, pp. 2563–2569.
- [C39] Z. McCarthy and T. Bretl, “Mechanics and manipulation of planar elastic kinematic chains,” in *IEEE International Conference on Robotics and Automation (ICRA)*, St. Paul, MN, May 2012.
- [C38] C. Orduno, A. Becker, and T. Bretl, “Motion primitives for path following with a self-assembled robotic swimmer,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2012.
- [C37] A.-S. Puydupin-Jamin, M. Johnson, and T. Bretl, “A convex approach to inverse optimal control and its application to modeling human locomotion,” in *IEEE International Conference on Robotics and Automation (ICRA)*, St. Paul, MN, May 2012.
- [C36] N. Aghasadeghi and T. Bretl, “Maximum entropy inverse reinforcement learning in continuous state spaces with path integrals,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Sep. 2011, pp. 1561–1566.
- [C35] A. Akce and T. Bretl, “A compact representation of locally-shortest paths and its application to a human-robot interface,” in *IEEE International Conference on Robotics and Automation (ICRA)*, May 2011, pp. 2713–2718.
- [C34] C. Das, A. Becker, and T. Bretl, “Probably approximately correct coverage for robots with uncertainty,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2011.
- [C33] Y. Li, K. Shorter, E. Hsiao-Wecksler, and T. Bretl, “Simulation and experimental analysis of a portable powered ankle-foot orthosis control,” in *ASME Dynamic Systems and Control Conference*, 2011.
- [C32] E. Morris, K. Shorter, Y. Li, E. Hsiao-Wecksler, T. Bretl, G. Kogler, and W. Durfee, “Actuation timing strategies for a portable powered ankle foot orthosis,” in *ASME Dynamic Systems and Control Conference*, 2011.
- [C31] A. Akce and T. Bretl, “A probabilistic language model for hand drawings,” in *International Conference on Pattern Recognition*, 2010.
- [C30] A. Akce, M. Johnson, and T. Bretl, “Remote teleoperation of an unmanned aircraft with a brain-machine interface: Theory and preliminary results,” in *IEEE International Conference on Robotics and Automation (ICRA)*, Anchorage, AK, May 2010.
- [C29] A. Becker and T. Bretl, “Motion planning under bounded uncertainty using ensemble control,” in *Robotics: Science and Systems (RSS)*, 2010.
- [C28] I. De Pablo, A. Becker, and T. Bretl, “An optimal solution to the linear search problem for a robot with dynamics,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2010, pp. 652–657.
- [C27] R. D. Gregg, T. Bretl, and M. W. Spong, “A control theoretic approach to robot-assisted locomotor therapy,” in *IEEE Conference on Decision and Control*, Dec. 2010, pp. 1679–1686.
- [C26] R. D. Gregg, T. Bretl, and M. Spong, “Asymptotically stable gait primitives for planning dynamic bipedal locomotion in three dimensions,” in *IEEE International Conference on Robotics and Automation (ICRA)*, May 2010.
- [C25] Y. Li, K. A. Shorter, T. Bretl, and E. T. Hsiao-Wecksler, “Power consumption and control of a pneumatic powered ankle foot orthosis,” in *FPNI Symposium*, Purdue, IN, 2010.
- [C24] D. Steines, T. Bretl, E. Maclin, and T. Coleman, “Application of feedback-related negativity to brain-computer interface,” in *Society for Neuroscience*, San Diego CA, 2010.

- [C23] A. Becker, R. Sandheinrich, and T. Bretl, “Automated manipulation of spherical objects in three dimensions using a gimbaled air jet,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, St. Louis, MO, Oct. 2009, pp. 781–786.
- [C22] D. DeVon and T. Bretl, “Control of many agents moving in the same direction with different speeds: A decoupling approach,” in *American Control Conference*, St. Louis, MO, 2009.
- [C21] C. Omar, M. Johnson, T. Bretl, and T. P. Coleman, “Policies for neural prosthetic control: Initial experiments with a text interface,” in *American Control Conference*, Seattle, WA, Jun. 2008.
- [C20] C. Omar, M. Johnson, T. Bretl, and T. Coleman, “Querying the user properly for high-performance brain-machine interfaces: Recursive estimation, control, and feedback information-theoretic perspectives,” in *IEEE International Conference on Acoustics, Speech, and Signal Processing*, Las Vegas, NV, 2008.
- [C19] T. Bretl, “Control of many agents by moving their targets: Maintaining separation,” in *International Conference on Advanced Robotics*, Jeju, Korea, Aug. 2007.
- [C18] T. Bretl, “Control of many agents with few instructions,” in *Robotics: Science and Systems*, Atlanta, GA, Jun. 2007.
- [C17] D. DeVon and T. Bretl, “Kinematic and dynamic control of a wheeled mobile robot,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2007.
- [C16] T. Bretl and S. Lall, “A fast and adaptive test of static equilibrium for legged robots,” in *IEEE International Conference on Robotics and Automation (ICRA)*, 2006.
- [C15] K. Harada, K. Hauser, T. Bretl, and J.-C. Latombe, “National motion generation for humanoid robots,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Beijing, China, 2006.
- [C14] K. Hauser, T. Bretl, K. Harada, and J.-C. Latombe, “Using motion primitives in probabilistic sample-based planning for humanoid robots,” in *Workshop on the Algorithmic Foundations of Robotics (WAFR)*, New York, NY, 2006.
- [C13] K. Hauser, T. Bretl, J.-C. Latombe, and B. Wilcox, “Motion planning for a six-legged lunar robot,” in *Workshop on the Algorithmic Foundations of Robotics (WAFR)*, New York, NY, 2006.
- [C12] T. Miller, T. Bretl, and S. Rock, “Control of a climbing robot using real-time convex optimization,” in *IFAC Symposium on Mechatronic Systems*, Heidelberg, Germany, Sep. 2006.
- [C11] K. Hauser, T. Bretl, and J.-C. Latombe, “Learning-assisted multi-step planning,” in *IEEE International Conference on Robotics and Automation (ICRA)*, Barcelona, Spain, 2005.
- [C10] K. Hauser, T. Bretl, and J.-C. Latombe, “Non-gaited humanoid locomotion planning,” in *Humanoids*, Tsukuba, Japan, 2005.
- [C9] T. Bretl, S. Lall, J.-C. Latombe, and S. Rock, “Multi-step motion planning for free-climbing robots,” in *Workshop on the Algorithmic Foundations of Robotics (WAFR)*, Zeist, Netherlands, 2004.
- [C8] T. Bretl, S. Rock, J.-C. Latombe, B. Kennedy, and H. Aghazarian, “Free-climbing with a multi-use robot,” in *International Symposium on Experimental Robotics*, Singapore, 2004.
- [C7] T. Bretl, J.-C. Latombe, and S. Rock, “Toward autonomous free-climbing robots,” in *International Symposium on Robotics Research*, Siena, Italy, 2003.
- [C6] T. Bretl, T. Miller, S. Rock, and J.-C. Latombe, “Climbing robots in natural terrain,” in *i-SAIRAS*, Nara, Japan, 2003.
- [C5] T. Bretl, S. Rock, and J.-C. Latombe, “Motion planning for a three-limbed climbing robot in vertical natural terrain,” in *IEEE International Conference on Robotics and Automation (ICRA)*, Taipei, Taiwan, 2003.
- [C4] T. Bretl and S. Rock, “Robust execution of aggressive maneuvers for planetary robotics,” in *AIAA Guidance, Navigation, and Control Conference and Exhibit*, Monterey, CA, 2002.
- [C3] T. Bretl and S. Rock, “Planning robust dynamic transitions for enhanced mobility of planetary rovers,” in *IFAC Conference on Mechatronic Systems*, Berkeley, CA, 2002.
- [C2] C. Clark, T. Bretl, and S. Rock, “Applying kinodynamic randomized motion planning with a dynamic priority system to multi-robot space systems,” in *IEEE Aerospace Conference*, vol. 7, 2002, pp. 3621–3631.



- [C1] K. Stein, R. Benney, T. Tezduyar, V. Kalro, J. Potvin, and T. Bretl, “Fluid-structure interaction simulation of a cross parachute: Comparison of numerical predictions with wind tunnel data,” in *CEAS/AIAA Aerodynamic Decelerator Systems Technology Conference and Seminar*, Toulouse, France, 1999.

## Book Chapters

- [B8] A. Akhtar, M. Nguyen, L. Wan, B. Boyce, P. Slade, and T. Bretl, “Passive mechanical skin stretch for proprioception in a hand prosthesis,” in *Haptics: Neuroscience, Devices, Modeling, and Applications*, ser. Lecture Notes in Computer Science, M. Auvray and C. Duriez, Eds., Springer Berlin Heidelberg, 2014, pp. 120–128.
- [B7] T. Bretl and Z. McCarthy, “Equilibrium configurations of a kirchhoff elastic rod under quasi-static manipulation,” in *Algorithmic Foundations of Robotics X*, ser. Springer Tracts in Advanced Robotics, E. Frazzoli, T. Lozano-Perez, N. Roy, and D. Rus, Eds., vol. 86, Springer Berlin Heidelberg, 2013, pp. 71–87.
- [B6] T. Bretl, “Control of many agents by moving their targets: Maintaining separation,” in *Recent Progress in Robotics: Viable Robotic Service to Human*, ser. Lecture Notes in Control and Information Sciences, S. Lee, I. H. Suh, and M. S. Kim, Eds., vol. 370, Springer Berlin Heidelberg, 2008, pp. 145–156.
- [B5] K. Hauser, T. Bretl, K. Harada, and J.-C. Latombe, “Using motion primitives in probabilistic sample-based planning for humanoid robots,” in *Algorithmic Foundation of Robotics VII*, ser. Springer Tracts in Advanced Robotics, S. Akella, N. Amato, W. Huang, and B. Mishra, Eds., vol. 47, Springer Berlin Heidelberg, 2008, pp. 507–522.
- [B4] K. Hauser, T. Bretl, J.-C. Latombe, and B. Wilcox, “Motion planning for a six-legged lunar robot,” in *Algorithmic Foundation of Robotics VII*, ser. Springer Tracts in Advanced Robotics, S. Akella, N. Amato, W. Huang, and B. Mishra, Eds., vol. 47, Springer Berlin Heidelberg, 2008, pp. 301–316.
- [B3] T. Bretl, S. Rock, J.-C. Latombe, B. Kennedy, and H. Aghazarian, “Free-climbing with a multi-use robot,” in *Experimental Robotics IX*, ser. Springer Tracts in Advanced Robotics, M. Ang and O. Khatib, Eds., vol. 21, Springer Berlin Heidelberg, 2006, pp. 449–458.
- [B2] T. Bretl, S. Lall, J.-C. Latombe, and S. Rock, “Multi-step motion planning for free-climbing robots,” in *Algorithmic Foundations of Robotics VI*, ser. Springer Tracts in Advanced Robotics, M. Erdmann, M. Overmars, D. Hsu, and F. van der Stappen, Eds., vol. 17, Springer Berlin Heidelberg, 2005, pp. 59–74.
- [B1] T. Bretl, J.-C. Latombe, and S. Rock, “Toward autonomous free-climbing robots,” in *Robotics Research: The Eleventh International Symposium*, ser. Springer Tracts in Advanced Robotics, P. Dario and R. Chatila, Eds., vol. 15, Springer Berlin Heidelberg, 2005, pp. 6–15.

## Thesis

- [T1] T. Bretl, “Multi-step motion planning: Application to free-climbing robots,” PhD thesis, Stanford University, 2005.

## Professional Activities

### Editorships of Journal Publications

- 2013-present Associate Editor, *IEEE Transactions on Robotics*.
- 2012-2016 Associate Editor, *IEEE Transactions on Automation Science and Engineering*.

### Editorships of Conference Publications

- 2014 Chair, Workshops and Tutorials, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.
- 2011-2012 Associate Editor, *IEEE International Conference on Robotics and Automation (ICRA)*.  
Associate Editor, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.

## Workshops Organized

- Sep 30, 2011 *IEEE Workshop on Progress and Open Problems in Motion Planning*, co-chair with K. Bekris and D. Halperin.
- Sep 14-15, 2009 *NSF-CMMI Workshop on Neuromechanical Engineering*, co-chair with N. Hogan.

## Invited Talks

- 2017 China-America Frontiers of Engineering Symposium (keynote talk), Shanghai, China.  
IEEE International Conference on Robotic Computing (keynote talk), Taichung, Taiwan.  
National Taiwan University, Taipei, Taiwan.
- 2015 University of Southern California, Los Angeles, CA.
- 2014 MIT, Boston, MA.  
University of Pennsylvania, Philadelphia, PA.  
Neuroengineering IGERT Symposium (plenary talk), University of Illinois at Urbana-Champaign, Urbana, IL.  
Tufts University, Boston, MA.  
Beckman Director's Seminar, University of Illinois at Urbana-Champaign, Urbana, IL.
- 2013 DLR, Wessling, Germany.  
KIT, Karlsruhe, Germany.  
Scuola Superiore Sant'Anna, Pontedera, Italy.  
Centro E. Piaggio, Pisa, Italy  
La Sapienza, Rome, Italy.  
Workshop Gepetto (LAAS-CNRS), Toulouse, France.  
EPFL, Lausanne, Switzerland.  
ETH, Zurich, Switzerland.  
Workshop on Inverse Optimal Control and Robotic Learning from Demonstration (at RSS), Berlin, Germany.  
LAAS-CNRS, Toulouse, France.
- 2012 Carnegie Mellon University, Pittsburgh, PA.  
University of Illinois at Chicago, Chicago, IL.  
North Carolina State University, Raleigh, NC.
- 2011 California Institute of Technology, Pasadena, CA.  
University of California at Berkeley, Berkeley, CA.  
University of Notre Dame, Notre Dame, IN.  
XII Congreso Internacional de Ingenieria Mecanica e Ingenieria Mecatronica (plenary talk, CI-IMM), Hermosillo, Mexico.  
George Washington University, Washington, DC.  
Rice University, Houston, TX.  
Northwestern University, Evanston, IL.  
Rehabilitation Institute of Chicago, Chicago, IL.  
Workshop on Uncertainty in Automation (at ICRA), Shanghai, China.

University of Nevada, Reno, NV.

TEDxUIUC, Urbana, IL.

- 2010 CIMAT (plenary talk, 3er Taller en Robotica y Planificacion de Movimientos), Guanajuato, Mexico.  
College of Applied Health Sciences (plenary talk, CHAD Symposium on Redefining Disability: New Directions in Research and Practice), Urbana, IL.  
Cornell University, Ithaca, NY.  
Workshop on Motion Planning: From Theory to Practice (at Robotics: Science and Systems), Zaragoza, Spain.  
Carnegie Mellon University, Pittsburgh, PA.
- 2007 Tecnolgico de Monterrey (plenary talk, Robbota 2007), Puebla, Mexico.  
Korea Institute of Science and Technology (KIST), Seoul, Korea.  
Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea.
- 2006 University of Illinois at Urbana-Champaign, Urbana, IL. UCLA, Los Angeles, CA. University of Wisconsin, Madison, WI. University of Michigan, Ann Arbor, MI.
- 2005 Cum Laude Induction Ceremony (Keynote Speech), The Blake School, Minneapolis, MN. Design and Manufacturing Forum (ME396 Seminar Series), Stanford, CA.
- 2003 Honda Research Institute, Mountain View, CA.