TIMOTHY BRETL

158 Coordinated Science Laboratory • 1308 West Main Street • Urbana, IL • 61801-2307
tbretl@illinois.edu • http://bretl.csl.illinois.edu/ • 217-244-3126

Research Interests

Planning, control, and optimization of robot motion. Engineering education.

Employment

2022-present	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).
2021-present	Severns Faculty Scholar, University of Illinois at Urbana-Champaign.
2016-present	Associate Head of Aerospace Engineering, University of Illinois at Urbana-Champaign.
2013-2022	Associate Professor of Aerospace Engineering, University of Illinois at Urbana-Champaign.
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

December 2021	Dr. David Hanley. Electrical and Computer Engineering. University of Illinois at Urbana-Champaign (Thesis: "Magnetic field-based navigation: empirical evidence of robust methods over contemporary methods").
August 2020	Dr. Xinke Deng. Electrical and Computer Engineering. University of Illinois at Urbana-Champaign (Thesis: "Vision-based 6D pose estimation for robot manipulation").
August 2018	Dr. Andy Borum. Aerospace Engineering, University of Illinois at Urbana-Champaign (Thesis: "Manipulation and mechanics of thin elastic objects").
August 2018	Dr. Joseph DeGol (co-advised with Derek Hoiem). Computer Science, University of Illinois at Urbana-Champaign (Thesis: "Towards Vision Based Robots for Monitoring Built Environments").
December 2017	Dr. James Norton. Neuroscience Program, University of Illinois at Urbana-Champaign (Thesis: "Steady-state visual evoked potentials and their application to brain-computer interfaces").

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

2021   *Severns Faculty Scholar*. University of Illinois at Urbana-Champaign.

2020   *List of Teachers Ranked as Excellent by Their Students (AE598RL: Reinforcement Learning for Dynamics and Control, Fall Semester)*. University of Illinois at Urbana-Champaign.

2019   *List of Teachers Ranked as Excellent by Their Students (AE353: Aerospace Control Systems, Spring Semester)*. University of Illinois at Urbana-Champaign.

2018   *Campus Award for Excellence in Undergraduate Teaching*. University of Illinois at Urbana-Champaign.

    College of Engineering Teaching Excellence Award. College of Engineering, University of Illinois at Urbana-Champaign.

    List of Teachers Ranked as Excellent by Their Students (AE353: Aerospace Control Systems, Fall Semester). University of Illinois at Urbana-Champaign.

    List of Teachers Ranked as Excellent by Their Students (AE482: Introduction to Robotics, Spring Semester). University of Illinois at Urbana-Champaign.

2017   *Rose Education Innovation Fellow*. 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.

    List of Teachers Ranked as Excellent by Their Students (AE353: Aerospace Control Systems, Spring Semester). University of Illinois at Urbana-Champaign.

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.

Publications

Journal Publications

[J40] X. Deng, J. Geng, T. Bretl, Y. Xiang, and D. Fox, "Icaps: Iterative category-level object pose and shape estimation," *IEEE Robotics and Automation Letters*, vol. 7, no. 2, pp. 1784–1791, 2022.

[J39] J. Lee, D. Hanley, and T. Bretl, "Extrinsic calibration of multiple inertial sensors from arbitrary trajectories," *IEEE Robotics and Automation Letters*, vol. 7, no. 2, pp. 2055–2062, 2022.

[J38] A. T. Perry, T. Bretl, and P. J. Ansell, "System identification of a subscale distributed electric propulsion aircraft," *Journal of Aircraft*, 2022, To appear.

[J37] X. Deng, A. Mousavian, Y. Xiang, F. Xia, T. Bretl, and D. Fox, "PoseRBPF: A rao-blackwellized particle filter for 6-d object pose tracking," *IEEE Transactions on Robotics*, vol. 37, no. 5, pp. 1328–1342, Oct. 2021.

[J36] D. Hanley, A. S. D. de Olivera, X. Zhang, D. H. Kim, Y. Wei, and T. Bretl, "The impact of height on indoor positioning with magnetic fields," *IEEE Transactions on Instrumentation and Measurement*, vol. 70, pp. 1–19, 2021.

[J35] A. T. Perry, T. Bretl, and P. J. Ansell, "Aeropropulsive coupling effects on a general-aviation aircraft with distributed electric propulsion," *Journal of Aircraft*, vol. 58, no. 6, pp. 1351–1363, 2021.

[J34] A. Borum and T. Bretl, "Infinitely long isotropic kirchhoff rods with helical centerlines cannot be stable," *Physical Review E*, vol. 102, no. 2, p. 023 004, 2020.

[J33] A. Borum and T. Bretl, "When is a helix stable?" *Physical Review Letters*, vol. 125, no. 8, p. 088 001, 2020.

[J32] A. Sintov, S. Macenski, A. Borum, and T. Bretl, "Motion planning for dual-arm manipulation of elastic rods," *IEEE Robotics and Automation Letters*, vol. 5, no. 4, pp. 6065–6072, 2020.

[J31] T. Bretl, L. Righetti, and R. Madhavan, "Epstein, project maven, and some reasons to think about where we get our funding [ethical, legal, and societal issues]," vol. 26, no. 4, pp. 8–13, Dec. 2019.

[J30] L. Tian, B. Zimmerman, A. Akhtar, *et al.*, "Large-area mri-compatible epidermal electronic interfaces for prosthetic control and cognitive monitoring," *Nature Biomedical Engineering*, vol. 3, no. 3, pp. 194–205, 2019.

[J29] A. Akhtar, J. Sombeck, B. Boyce, and T. Bretl, "Controlling sensation intensity for electrotactile stimulation in human-machine interfaces," *Science Robotics*, vol. 3, no. 17, 2018.

[J28] T. Bretl, "Teaching undergraduate courses on robotics and control in prison," *Mechanical Engineering Magazine Select Articles*, vol. 140, no. 09, S11–S16, Sep. 2018.

[J27] J. J. S. Norton, J. Mullins, B. E. Alitz, and T. Bretl, "The performance of 9–11-year-old children using an SSVEP-based BCI for target selection," *Journal of Neural Engineering*, vol. 15, no. 5, p. 056 012, Jul. 2018.

[J26] A. Sintov, A. Borum, and T. Bretl, "Motion planning of fully actuated closed kinematic chains with revolute joints: A comparative analysis," *IEEE Robotics and Automation Letters*, vol. 3, no. 4, pp. 2886–2893, Oct. 2018.

[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] 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. 2017.

[J23] 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.

[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] Y. Liu, J. J. S. Norton, R. Qazi, *et al.*, "Epidermal mechano-acoustic sensing electronics for cardiovascular diagnostics and human-machine interfaces," *Science Advances*, vol. 2, no. 11, 2016.

[J20] B. Xu, A. Akhtar, Y. Liu, *et al.*, "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, *et al.*, "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, *et al.*, "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, *et al.*, "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

[C97]   E. Saleh, S. Ghaffari, T. Bretl, and M. West, "Truly deterministic policy optimization," in *NeurIPS*, To appear, 2022.

[C96]   A. Augustyniak, D. J. Hanley, T. W. Bretl, N. J. Hejmanowski, and D. L. Carroll, "A preliminary framework and feasibility study for spacecraft disturbance source detection and isolation with distributed inertial sensors," in *AIAA Scitech*, 2021.

[C95]   C. Emeka, T. Bretl, G. Herman, M. West, and C. Zilles, "Students' perceptions and behavior related to second-chance testing," in *IEEE Frontiers in Education Conference (FIE)*, 2021.

[C94] M. West, N. Walters, M. Silva, T. Bretl, and C. Zilles, "Integrating diverse learning tools using the prairielearn platform," in *Seventh SPLICE Workshop at SIGCSE*, 2021.

[C93] X. Deng, Y. Xiang, A. Mousavian, C. Eppner, T. Bretl, and D. Fox, "Self-supervised 6d object pose estimation for robot manipulation," in *IEEE International Conference on Robotics and Automation (ICRA)*, 2020, pp. 3665–3671.

[C92] G. Herman, Z. Cai, T. Bretl, C. Zilles, and M. West, "Comparison of grade replacement and weighted averages for second-chance exams," in *ACM Conference on International Computing Education Research (ICER)*, 2020.

[C91] A. Verma, T. Bretl, M. West, and C. Zilles, "A quantitative analysis of when students choose to grade questions on computerized exams with multiple attempts," in *Learning at Scale (L@S)*, 2020.

[C90] B. Chen, C. Zilles, M. West, and T. Bretl, "Effect of discrete and continuous parameter variation on difficulty in automatic item generation," in *Artificial Intelligence in Education (AIED)*, ser. Lecture Notes in Computer Science, vol. 11625, Springer, Cham, 2019.

[C89] X. Deng, A. Mousavian, Y. Xiang, F. Xia, T. Bretl, and D. Fox, "PoseRBPF: A rao-blackwellized particle filter for 6d object pose estimation," in *Proceedings of Robotics: Science and Systems*, Freiburg im Breisgau, Germany, Jun. 2019.

[C88] C. W. Lee, A. Schleife, D. R. Trinkle, *et al.*, "Impact of computational curricular reform on non-participating undergraduate courses: Student and faculty perspective," in *ASEE Annual Conference and Exposition*, 2019.

[C87] A. T. Perry, T. Bretl, and P. J. Ansell, "System identification and dynamics modeling of a distributed electric propulsion aircraft," in *AIAA Aviation Forum*, 2019.

[C86] C. Zilles, M. West, G. Herman, and T. Bretl, "Every university should have a computer-based testing facility," in *International Conference on Computer Supported Education (CSEDU)*, SciTePress, 2019, pp. 414–420.

[C85] J. Degol, J. Y. Lee, R. Kataria, D. Yuan, T. Bretl, and D. Hoiem, "Feats: Synthetic feature tracks for structure from motion evaluation," in *International Conference on 3D Vision (3DV)*, Sep. 2018, pp. 352–361.

[C84] J. DeGol, T. Bretl, and D. Hoiem, "Improved structure from motion using fiducial marker matching," in *European Conference on Computer Vision (ECCV)*, Sep. 2018, pp. 281–296.

[C83] X. Deng, Z. Zhang, A. Sintov, J. Huang, and T. Bretl, "Feature-constrained active visual slam for mobile robot navigation," in *IEEE International Conference on Robotics and Automation (ICRA)*, May 2018, pp. 7233–7238.

[C82] D. Hanley, X. Zhang, A. S. Dantas de Oliveira, D. Steinberg, and T. Bretl, "Experimental evaluation of the planar assumption in magnetic positioning," in *International Conference on Indoor Positioning and Indoor Navigation (IPIN)*, Sep. 2018, pp. 1–8.

[C81] K. C. Pieper, A. T. Perry, P. J. Ansell, and T. Bretl, "Design and development of a dynamically scaled distributed electric propulsion aircraft testbed," in *AIAA/IEEE Electric Aircraft Technologies Symposium*, 2018.

[C80] X. Zhang, A. Schleife, A. Ferguson, *et al.*, "Computational curriculum for matse undergraduates and the influence on senior classes," in *ASEE Annual Conference*, 2018.

[C79] C. Zilles, M. West, D. Mussulman, and T. Bretl, "Making testing less trying: Lessons learned from operating a computer-based testing facility," in *IEEE Frontiers in Education Conference (FIE)*, Oct. 2018, pp. 1–9.

[C78] 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.

[C77] J. Cornman, A. Akhtar, and T. Bretl, "A portable, arbitrary waveform, multichannel constant current electrotactile stimulator," in *International IEEE/EMBS Conference on Neural Engineering (NER)*, May 2017, pp. 300–303.

[C76] J. DeGol, T. Bretl, and D. Hoiem, "Chromatag: A colored marker and fast detection algorithm," in *International Conference on Computer Vision (ICCV)*, 2017.

[C75] D. Hanley, A. B. Faustino, S. D. Zelman, D. A. Degenhardt, and T. Bretl, "Magpie: A dataset for indoor positioning with magnetic anomalies," in *International Conference on Indoor Positioning and Indoor Navigation (IPIN)*, Sep. 2017, pp. 1–8.

[C74]   A. Ibrahim, D. Roberts, M. Golparvar-Fard, and T. Bretl, "An interactive model-driven path planning and data capture system for camera-equipped aerial robots on construction sites," in *Computing in Civil Engineering*, 2017, pp. 117–124.

[C73]   D. Roberts, T. Bretl, and M. Golparvar-Fard, "Detecting and classifying cranes using camera-equipped uavs for monitoring crane-related safety hazards," in *Computing in Civil Engineering*, 2017, pp. 442–449.

[C72]   A. Akhtar, K. Y. Choi, M. Fatina, *et al.*, "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 imus," 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 electrotactile 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 ssvep-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 non-linear 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, *et al.*, "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," Ph.D. dissertation, Stanford University, 2005.

Professional Activities

Editorships of Journal Publications

2013-2017   Associate Editor, *IEEE Transactions on Robotics*.

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

Editorships of Conference Publications

2021-2022   Area Chair, *Robotics: Science and Systems (RSS)*.

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

2021   University of California at Berkeley, Berkeley, CA.

2020   New York University, New York, NY.

Rice University, Houston, TX.

2019   Robotics Institute Seminar, Carnegie Mellon University, Pittsburgh, PA.

2018   Johns Hopkins University, Baltimore, MD.

Midwest Robotics Workshop, Chicago, IL.

2017   Oregon State University, Corvallis, OR.

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. Piaggo, 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   Tecnologico 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.