Devin J. Balkcom

CONTACT INFORMATION

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RESEARCH INTERESTS

Efficient designs and algorithms for robot locomotion and manipulation.
How can robotics problems be solved in simple, effective ways?

EDUCATION

Carnegie Mellon University, Robotics Ph.D. 2004. Advisor Matthew Mason.
Johns Hopkins University, B.A. 1998

APPOINTMENTS

Department Chair, Dartmouth Computer Science	**2020 – present**
Professor, Dartmouth College	**2020 – present**
Associate Professor, Dartmouth College	**2010-2020**
Faculty Co-director of Academic Computing, Dartmouth College	**2013 – 2016**
Assistant Professor, Dartmouth College	**2004 – 2010**

AWARDS

Dartmouth Dean of Faculty Award for Outstanding Mentoring and Advising, 2020
Dartmouth McLane Family Fellowship, 2010.
John M. Manley Huntington Award for Newly Tenured Faculty, 2010.
NSF CAREER award, 2006.
Department of Energy Computational Science Graduate Fellowship, 2000

FUNDING

A Scalable and Accessible System for Automated Coaching of Human Motion **2022 – 2025**
co-PI. Total funding $849k, with PI David Kraemer.

Collab. Research: RI: Medium: Robust Assembly of Compliant Modular Robots **2020 – 2023**
PI. Total funding $750k, with Bekris (Rutgers), Kramer (Yale), Wang (Albany).

NSF MRI: Acq. of marine multirobot systems for underwater monitoring and construction **2019 – 2022**
co-PI. Total funding $400k, with Quattrini Li, Casana, Zhou, Zhu.

RII Track-2 FEC: Computational Methods and Autonomous Robotics Systems for Modeling and Predicting Harmful Cyanobacterial Blooms **2019 – 2023**
Total funding $2.9M, renewable to $5.9M, P.I. Quattrini Li
(senior personnel; single investigator per institution)

NSF Cyberlearning: Teaching Human Motion at Population Scale **2018 – 2021**
PI. Total funding $750k, with Kraemer, Zhou, Wang.

NSF RI: Computational joinery **2018 – 2020**
PI. Total funding $500k, with Whiting, Wang.

MBR Space Settlement Challenge **2018**
$16,000.

Adobe Research gift **2017**
$10,000.

Neukom Comp-X grant: Computational design of deployable structures **2016**
$15,000. With Emily Whiting.

NSF EAGER: Computing compact roadmaps for motion planning **2014 – 2016**
P.I. $150k.

NSF RI: Practical techniques for robotic manipulation of string and wire **2012 – 2016**
P.I. $482k.

Neukom Comp-X grant: Efficient representations for robot motion planning **2012**
$20k. With Amit Chakrabarti.

NSF Infrastructure grant: Digital Imaging Laboratory at Dartmouth **2007 – 2010**
$480k. With Hany Farid, Fabio Pellacini, Lorie Loeb.

NSF CAREER award **2006 – 2011**
$400k.

Department of Justice (ISTS): Mobility assessment for emergency response robots **2006 – 2008**
$250k. Co-PI with Laura Ray.

Department of Justice Byrne Grant: automated assistance for disaster response **2005 – 2007**
$181k. Co-PI with Laura Ray.

Department of Energy Computational Science Graduate Fellowship **2000 – 2004**
Full graduate student support; approximately $220k.

PH.D. STUDENTS

Julien Blanchet	September 2019 – present
Luyang Zhao	September 2018 – present
Sam Lensgraf (coadvised by A. Quattrini Li)	September 2018 – present
Qijia Shao (coadvised by Xia Zhou)	November 2018 – June 2022
Amy Sniffen	November 2018 – present
Yinan Zhang	Ph.D. June 2019
Yu-Han Lyu	Ph.D. June 2016
Weifu Wang	Ph.D. June 2016
Andrei Furtuna	Ph.D. June 2011
Paritosh Kavathekar	Ph.D. June 2011
Matthew Bell	Ph.D. February 2010

M.S. STUDENTS

Yijia Wu	current
Evan Honnold	July 2019
Fahad Hamid	July 2019
Chang Jo Kim	September 2013
Zhong Li	June 2013
Wenyu Lu	August 2011
Govind Krishnan	September 2009
Wei Zhang (coadvised by Paul Thompson)	June 2007
Anne Loomis	June 2006

COURSES TAUGHT

Tuck FWP: Fundamentals of Web Programming 2016 – 2020

With Hany Farid, designed, developed, and taught a new course for Tuck students interested in the intersection of technology and business. This hands-on-course covers web development in Javascript, HTML, CSS, with a particular emphasis on business applications.

Tuck DSA: Data structures and analytics 2017

With Hany Farid, designed, developed, and taught a new course for Tuck students interested in the intersection of technology and business. This hands-on-course follows the prior FWP course, and covers managing data in databases, representing data for computation in data structures, and data analysis using techniques from computer science and machine learning, with a particular emphasis on business applications.

CS 1: Introduction to Programming and Computation 2005 – present

I designed and developed a new introductory undergraduate course, intended for both majors and non-majors. The course is programming intensive, and teaches fundamentals of Python programming, introductory object-oriented design, and topics from algorithms and data structures, including linked lists, trees, graphs, breadth-first search, and finite automata.

CS 10: Problem Solving with Object Oriented Programming 2023

Our second-level course in the introductory sequence; implementation of data structures and algorithms.

CS 81: Principles of Robot Design and Programming 2006 – present

This advanced undergraduate course that I developed covers robot design and programming. There are two primary foci: a sequence of labs, and a rigorous introduction to mathematical techniques for analysis. The labs involve four mobile robots that the students program to autonomously explore a maze, and a real industrial robot arm that the student program for manipulation and assembly tasks. The mathematical analysis side covers kinematics, dynamics, the basics of modern control, and analysis of the stability of robot grasping.

CS 76: Artificial Intelligence various years, 2005 – present

This senior undergraduate course introduces basic applications and techniques in the field of Artificial Intelligence. Topics include knowledge representation, A* and iterative deepening search, scheduling, logic and theorem proving, competitive and cooperative games, optimization, probabilistic inference, with applications to robotics, natural language processing, and computer game development.

CS 50: Software Design and Implementation 2011, 2013

This course is an intermediate course in software development and design. Students who have completed the first two introductory courses build a team project in this course, using C and Unix development tools. In the version of the course I developed and taught, students built a multiplayer, networked, threaded implementation of a music-teaching game along the lines of the well-known commercial *Guitar Hero* game.

CS 89: Robotics seminar 2005 – 2018

This undergraduate/graduate course presents basic techniques for modeling, simulation, planning, and control of robotic systems. Topics covered include configuration space, kinematics of open and closed chains, representations of rotations in 2D and 3D, homogeneous coordinates, constrained dynamics, the dynamics of friction and contact. Lab work includes programming an industrial robot arm.

CS 98: Senior design project 2012, 2013, 2014, 2015

This course represents a culminating experience for graduating senior undergraduates. As part of a team, students design, develop, test, and release a piece of software.

CS 69: Design projects course 2013

This course is a team-project course along the lines of CS 98, but targeted at first-, second-, and third-year students.

UNDERGRADUATE RESEARCH ADVISING

I have supervised more than 80 undergraduates on individual research projects, through the Dartmouth Women in Science Project, Presidential fellowship program, E.E. Just minority research program, and for senior theses.

Professional Committees

IEEE Robotics and Automation Letters Associate Editor 2015 – 2018

NSF proposal review panels 2008, 2009, 2012, 2013, 2014, 2015

Workshop on the Algorithmic Foundations of Robotics (WAFR) program committee 2010, 2012, 2014, 2016

IEEE/RSJ International Conference on Intelligent Robots and Systems associate editor. 2005, 2006, 2007, 2011, 2012, 2013, 2014

IEEE International Conference on Robotics and Automation associate editor. 2011, 2012, 2013, 2014

Robotics: Science and Systems program committee. 2005, 2006, 2007, 2008, 2010, 2012

Reviewer for *The International Journal of Robotics Research*, the *IEEE Transactions on Robotics and Automation*, and other international journals. Judge for FIRST lego robotics competition, and for ASME National Student Mechanical Design Competition. Program committee member for *AAAI* and *Intelligent Autonomous Systems*. Area and publicity chair for *Robotics: Science and Systems* (2009).

UNDERGRADUATES ADVISED SINCE 2012

Numbers in parenthesis indicate number of terms supervised on research or development project.

1. Maxine Perroni-Scharf (3) Senior honors thesis
2. Xingran Zhuang (2) Senior thesis
3. Shoshana Geller (1) Lab RA
4. Gregory Hunter (1) Lab RA
5. Andrea Jenkins (1) Lab RA
6. Xingran.Zhuang (1) Lab RA
7. Christina Lu (1) Presidential scholar
8. Karim Itani (1) Lab RA
9. Jennifer Jain (2) Lab RA
10. David Mena (1) Lab RA
11. Geoffry Wang (4) Lab RA
12. Lisa Oh (5) Senior thesis
13. Josiah Putman (4) Neukom Fellow
14. Madeleine Genereux (1) Lab RA
15. David Perez Gonzalez (1) E.E. Just Fellow
16. Janvi Kalra (2) Lab RA
17. Eitan Vilker (1) Lab RA
18. Braden Pellowski (1) Senior thesis
19. Cara Van Uden (1) Lab RA
20. Magdalene Pizzo (1) Lab RA
21. Robert Livaudis (1) Lab RA
22. Evan Honnold (4) Senior thesis
23. Galen Brown (3) Senior thesis
24. Anthony Addo (2) Senior thesis
25. Yusuf Olokoba (6) E.E. Just Fellow
26. Ping-Jung Liu (1) Lab RA
27. Zachary Johnson (2) Lab RA
28. Yichen Ke (2) Presidential scholar
29. Hang Qi (4) Presidential scholar
30. Pritika Vg (2) Senior thesis
31. Michael Li (5) Senior thesis, Neukom scholar
32. Kaya Thomas (2) Independent study for credit
33. Nan Hu (3) Presidential scholar
34. Ella Ryan (3) Presidential scholar
35. Justin Chan (3) Presidential scholar
36. Ajay Kannan (3) Senior thesis
37. Richard Addo (1) Course credit
38. Hanna Kim (2016, 1) Course credit
39. Yining Chen (4) Presidential scholar
40. Justin Murray (3) Senior thesis
41. Jonathan Guinter (3) Senior thesis
42. Delos Chang (2) Senior thesis
43. Will Jackson (2) Senior thesis
44. Jordan Kunzika (8) Sophomore Science, lab RA
45. George Boateng (6) Sophomore Science, lab RA
46. Charles Pastuzenski (2) Presidential scholar
47. Kelsey Harris (3) Senior thesis
48. E McNeil (3) Senior thesis
49. Divya Gunasekaran (3) Senior thesis
50. Parker Phinney (3) Senior thesis
51. Ambrose Granizo-Mackenzie (4) Hanover high, lab RA
52. Stephen Malina (2) lab RA
53. Dan Carter (2) lab RA
54. Callen Votzke (10), lab RA
55. Xander Eisensten (1), lab RA
56. Peter Stein (2), reading course
57. Kevin NiParko (2), reading course
58. David Rogg (2), reading course
59. Carla Galarza (1) Summer robotics camp instructor/ developer
60. Sucharita Jayanti (1) Summer robotics camp instructor/ developer
61. Max Diebel (1) Summer robotics camp instructor/ developer
62. Daniel Mott (2) Lab RA
63. Jennifer Lure (2) Lab RA

JOURNAL ARTICLES

[1] Meysam Effati, Krzysztof Skonieczny, and Devin J. Balkcom. "Energy-optimal trajectories for skid-steer rovers". In: *Int. J. Robotics Res.* 43.2 (2024), pp. 171–202.

[2] Luyang Zhao, Yijia Wu, Wenzhong Yan, Weishu Zhan, Xiaonan Huang, Joran W. Booth, Ankur Mehta, Kostas E. Bekris, Rebecca Kramer-Bottiglio, and Devin J. Balkcom. "StarBlocks: Soft Actuated Self-Connecting Blocks for Building Deformable Lattice Structures". In: *IEEE Robotics Autom. Lett.* 8.8 (2023), pp. 4521–4528.

[3] Luyang Zhao, Yijia Wu, Julien Blanchet, Maxine Perroni-Scharf, Xiaonan Huang, Joran W. Booth, Rebecca Kramer-Bottiglio, and Devin J. Balkcom. "Soft Lattice Modules That Behave Independently and Collectively". In: *IEEE Robotics Autom. Lett.* 7.3 (2022), pp. 5942–5949.

[4] Yinan Zhang, Yotto Koga, and Devin J. Balkcom. "Interlocking Block Assembly With Robots". In: *IEEE Trans Autom. Sci. Eng.* 18.3 (2021), pp. 902–916.

[5] Luyang Zhao, Yijia Wu, Julien Blanchet, Maxine Perroni-Scharf, Xiaonan Huang, Joran W. Booth, Rebecca Kramer-Bottiglio, and Devin J. Balkcom. "Soft Lattice Modules that Behave Independently and Collectively". In: *Robotics and Automation Letters* (2021). To appear.

[6] Qijia Shao, Amy Sniffen, Julien Blanchet, Megan E. Hillis, Xinyu Shi, Themistoklis K. Haris, Jason Liu, Jason Lamberton, Melissa Malzkuhn, Lorna C. Quandt, James Mahoney, David J. M. Kraemer, Xia Zhou, and Devin J. Balkcom. "Teaching American Sign Language in Mixed Reality". In: *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 4.4 (2020), 152:1–152:27.

[7] Ruibo Liu, Qijia Shao, Siqi Wang, Christina Ru, Devin Balkcom, and Xia Zhou. "Reconstructing Human Joint Motion with Computational Fabrics". In: *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 3.1 (2019), 19:1–19:26.

[8] Yinan Zhang, Emily Whiting, and Devin Balkcom. "Assembling and disassembling planar structures with divisible and atomic components". In: *IEEE Transactions on Automation Science and Engineering* 15.3 (July 2018), pp. 945–954.

[9] Weifu Wang and Devin Balkcom. "Knot grasping, folding, and re-grasping". In: *International Journal of Robotics Research* 37.2-3 (Feb. 2018), pp. 378–399.

[10] Yu-Han Lyu and Devin Balkcom. "Optimal trajectories for planar rigid bodies with switching costs". In: *International Journal of Robotics Research* 35.5 (2016), pp. 454–475.

[11] Yu-Han Lyu, Yining Chen, and Devin Balkcom. "k-survivability: diversity and survival of expendable robots". In: *Robotics and Automation Letters* 1.2 (2016). Also published as ICRA article by the same name., pp. 1164–1171.

[12] Weifu Wang and Devin Balkcom. "Towards arranging and tightening knots and unknots with fixtures". In: *IEEE Transactions on Automation Science and Engineering* 12.4 (2015), pp. 1318–1331.

[13] Weifu Wang, Devin Balkcom, and Amit Chakrabarti. "A fast online spanner for roadmap construction". In: *International Journal of Robotics Research* 34.11 (2015), pp. 1418–1432.

[14] Matthew P. Bell, Weifu Wang, Jordan Kunzika, and Devin Balkcom. "Knot-tying with four-piece fixtures". In: *International Journal of Robotics Research* 33.11 (2014), pp. 1481–1489.

[15] Paritosh A. Kavathekar, Bruce A. Craig, Alan M. Friedman, Chris Bailey-Kellogg, and Devin Balkcom. "Characterizing the space of interatomic distance distribution functions consistent with solution scattering data". In: *Journal of Bioinformatics and Computational Biology* 8.2 (2010), pp. 315–335.

[16] Matthew P. Bell and Devin Balkcom. "Grasping non-stretchable cloth polygons". In: *International Journal of Robotics Research* 29.6 (2010), pp. 775–784.

[17] Andrei A. Furtuna and Devin Balkcom. "Generalizing Dubins curves: minimum-time sequences of body-fixed rotations and translations in the plane". In: *International Journal of Robotics Research* 29.6 (2010), pp. 703–726.

[18] Hamid Reza Chitsaz, Steven M. LaValle, Devin Balkcom, and Matthew T. Mason. "Minimum wheel-rotation paths for differential-drive mobile robots". In: *International Journal of Robotics Research* 28.1 (2009), pp. 66–80.

[19] Devin Balkcom and Matthew T. Mason. "Robotic origami folding". In: *International Journal of Robotics Research* 27.5 (2008), pp. 613–627.

[20] Devin Balkcom, Paritosh A. Kavathekar, and Matthew T. Mason. "Time-optimal trajectories for an omni-directional vehicle". In: *International Journal of Robotics Research* 25.10 (2006), pp. 985–999.

[21] Devin Balkcom and Jeffrey C. Trinkle. "Computing wrench cones for planar rigid body contact tasks". In: *International Journal of Robotics Research* 21.12 (2002), pp. 1053–1066.

[22] Devin Balkcom and Matthew T. Mason. "Time optimal trajectories for bounded velocity differential drive vehicles". In: *International Journal of Robotics Research* 21.3 (2002), pp. 199–218.

CONFERENCE PAPERS

[23] Samuel Lensgraf, Devin J. Balkcom, and Alberto Quattrini Li. "Buoyancy enabled autonomous underwater construction with cement blocks". In: *IEEE International Conference on Robotics and Automation*. IEEE, 2023, pp. 5207–5213.

[24] Julien Blanchet, Megan E. Hillis, Yeongji Lee, Qijia Shao, Xia Zhou, David J. M. Kraemer, and Devin J. Balkcom. "LearnThatDance: Augmenting TikTok Dance Challenge Videos with an Interactive Practice Support System Powered by Automatically Generated Lesson Plans". In: *Adjunct Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology, UIST*. ACM, 2023, 84:1–84:4.

[25] Julien Blanchet, Megan E. Hillis, Yeongji Lee, Qijia Shao, Xia Zhou, David J. M. Kraemer, and Devin J. Balkcom. "Automatic Generation and Teaching of Dance Lessons from Video". In: *Proceedings of the 24th International Workshop on Mobile Computing Systems and Applications, HotMobile 2023*. ACM, 2023, p. 145.

[26] Megan E Hillis annd Brianna Aubrey, Julien Blanchet, Qijia Shao, Xia Zhou, Devin Balkcom, and David JM Kraemer. "Overlapping semantic representations of sign and speech in novice sign language learners". In: *Proceedings of the Annual Meeting of the Cognitive Science Society*. 2022, pp. 3346–3353.

[27] Samuel Lensgraf, Amy Sniffen, Alberto Quattrini Li, and Devin Balkcom. "Extended abstract: Towards the autonomous underwater construction of cement block structures with free-floating robots". In: *ICRA 2022 Construction Robotics Workshop*. 2022.

[28] Meysam Effati, Krzysztof Skonieczny, Tim Freiman, and Devin J. Balkcom. "An Equivalent Time-Optimal Problem to find Energy-Optimal Paths for Skid-Steer Rovers". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems, IROS, 2022*. IEEE, 2022, pp. 13341–13346.

[29] Samuel E. Lensgraf, Amy Sniffen, Zachary Zitzewitz, Evan Honnold, Jennifer Jain, Weifu Wang, Alberto Quattrini Li, and Devin J. Balkcom. "Droplet: Towards Autonomous Underwater Assembly of Modular Structures". In: *Robotics: Science and Systems XVII, Virtual Event, July 12-16, 2021*. 2021.

[30] Amy Sniffen, Zezhou Sun, Samuel E. Lensgraf, Emily Whiting, Alberto Quattrini Li, and Devin Balkcom. "Falling Into Place: Drop Assembly of Interlocking Puzzles". In: *Robotics: Science and Systems XVII, Virtual Event, July 12-16, 2021*. 2021.

[31] P Meng, W Wang, D Balkcom, and K E Bekris. "Proof-of-Concept Designs for the Assembly of Modular, Dynamic Tensegrities into Easily Deployable Structures". In: *ASCE Earth and Space Conference 2021*. Seattle, WA, 2021.

[32] Samuel Lensgraf, Karim Itani, Yinan Zhang, Zezhou Sun, Yijia Wu, Alberto Quattrini Li, Bo Zhu, Emily Whiting, Weifu Wang, and Devin J. Balkcom. "PuzzleFlex: kinematic motion of chains with loose joints". In: *2020 IEEE International Conference on Robotics and Automation, ICRA 2020*. IEEE, 2020, pp. 6730–6737.

[33] Luyang Zhao, Josiah Putman, Weifu Wang, and Devin J. Balkcom. "PLRC*: A piecewise linear regression complex for approximating optimal robot motion". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems, IROS 2020*. 2020, pp. 6681–6688.

[34] Josiah Putman, Lisa Oh, Luyang Zhao, Evan Honnold, Galen Brown, Weifu Wang, and Devin J. Balkcom. "Piecewise linear regressions for approximating distance metrics". In: *CoRR*. Vol. abs/2002.12466. 2020. eprint: 2002.12466.

[35] Josiah Putman, Lisa Oh, Luyang Zhao, Evan Honnold, Galen Brown, Weifu Wang, and Devin J. Balkcom. "LLDM: Locally linear distance maps for robot motion planning: Extended Abstract". In: *2019 International Symposium on Multi-Robot and Multi-Agent Systems, MRS*. 2019.

[36] Yinan Zhang and Devin Balkcom. "Interlocking block assembly". In: *Algorithmic Foundation of Robotics (WAFR)*. Dec. 2018.

[37] Weifu Wang and Devin Balkcom. "Time-optimal motion of spatial Dubins systems". In: *Algorithmic Foundation of Robotics (WAFR)*. Dec. 2018.

[38] Devin Balkcom, Andrei Furtuna, and Weifu Wang. "The Dubins car and other arm-like mobile robots". In: *IEEE International Conference on Robotics and Automation (ICRA)*. May 2018.

[39] Yinan Zhang, Xiaolei Chen, Hang Qi, and Devin Balkcom. "Rearranging agents in a small space using global controls". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2017.

[40] Paritosh Kavathekar and Devin Balkcom. "A tactile shirt for teaching human motion tasks". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2017.

[41] Yinan Zhang, Emily Whiting, and Devin Balkcom. "Assembling and disassembling planar structures with divisible and atomic components". In: *Algorithmic Foundations of Robotics (WAFR)*. 2016.

[42] Weifu Wang and Devin Balkcom. "Re-configuring knots to simplify manipulation". In: *Algorithmic Foundations of Robotics (WAFR)*. 2016.

[43] Yinan Zhang and Devin Balkcom. "Interlocking structure assembly with voxels". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2016.

[44] Weifu Wang and Devin Balkcom. "Grasping and folding knots". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2016.

[45] Weifu Wang and Devin Balkcom. "Towards tying knots precisely". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2016.

[46] Yu-Han Lyu, Yining Chen, and Devin Balkcom. "k-survivability: diversity and survival of expendable robots". In: *IEEE International Conference on Robotics and Automation (ICRA)*. Also published as RAL journal article by the same name. 2016.

[47] Devin Balkcom, Ajay Kannan, Yu-Han Lyu, Weifu Wang, and Yinan Zhang. "Metric cells: towards complete search for optimal trajectories". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2015.

[48] Weifu Wang, Dmitry Berenson, and Devin Balkcom. "An online method for tight-tolerance insertion tasks for string and rope". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2015.

[49] Yu-Han Lyu, Andrei A. Furtuna, Weifu Wang, and Devin Balkcom. "The bench mover's problem: minimum-time trajectories, with cost for switching between controls". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2014, pp. 106–112.

[50] Weifu Wang, Matthew Bell, and Devin Balkcom. "Towards arranging and tightening knots and unknots with fixtures". In: *Algorithmic Foundations of Robotics (WAFR)*. 2014.

[51] Yu-Han Lyu and Devin Balkcom. "Optimal trajectories for planar rigid bodies with switching costs". In: *Algorithmic Foundations of Robotics (WAFR)*. 2014.

[52] Weifu Wang, Devin Balkcom, and Amit Chakrabarti. "A fast streaming spanner algorithm for incrementally constructing sparse roadmaps". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2013, pp. 1257–1263.

[53] Zhong Li, Devin Balkcom, and Aaron M. Dollar. "Rigid 2D space-filling folds of unbroken linear chains". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2013, pp. 551–557.

[54] Andrei A. Furtuna, Weifu Wang, Yu-Han Lyu, and Devin Balkcom. "Structure and geometry of minimum-time trajectories for planar rigid bodies". In: *Allerton Conference on Communication, Control, and Computing*. 2013, pp. 1584–1591.

[55] Weifu Wang and Devin Balkcom. "Sampling extremal trajectories for planar rigid bodies". In: *Algorithmic Foundations of Robotics (WAFR)*. 2012, pp. 331–347.

[56] Weifu Wang and Devin Balkcom. "Analytical time-optimal trajectories for an omni-directional vehicle". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2012, pp. 4519–4524.

[57] Andrei A. Furtuna, Wenyu Lu, Weifu Wang, and Devin Balkcom. "Minimum-time trajectories for kinematic mobile robots and other planar rigid bodies with finite control sets". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2011, pp. 4321–4328.

[58] Andrei A. Furtuna, Devin Balkcom, Hamid Reza Chitsaz, and Paritosh A. Kavathekar. "Generalizing the Dubins and Reeds-Shepp cars: fastest paths for bounded-velocity mobile robots". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2008, pp. 2533–2539.

[59] Matthew P. Bell and Devin Balkcom. "Knot tying with single piece fixtures". In: *IEEE International Conference on Robotics and Automation, (ICRA)*. 2008, pp. 379–384.

[60] Laura Ray, James Joslin, John Murphy, Jon Barlow, Devin Brande, and Devin Balkcom. "Dynamic mobile robots for emergency surveillance and situational awareness". In: *IEEE International Workshop on Safety, Security, and Rescue Robotics*. 2006.

[61] Devin Balkcom, Erik Demaine, Martin Demaine, John Ochsendorf, and Zhong You. "Folding paper shopping bags". In: *International Meeting of Origami Science, Math, and Education (OSME)*. 2006, pp. 315–334.

[62] Devin Balkcom, Paritosh A. Kavathekar, and Matthew T. Mason. "The minimum-time trajectories for an omni-directional vehicle". In: *Algorithmic Foundation of Robotics (WAFR)*. Superceded by IJRR article. 2006, pp. 343–358.

[63] Anne Loomis and Devin Balkcom. "Computation reuse for rigid-body dynamics". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2006, pp. 4181–4186.

[64] Hamid Reza Chitsaz, Steven M. LaValle, Devin Balkcom, and Matthew T. Mason. "Minimum wheel-rotation Paths for differential-drive mobile robots". In: *IEEE International Conference on Robotics and Automation (ICRA)*. Superceded by IJRR paper. 2006, pp. 1616–1623.

[65] Devin Balkcom and Matthew T. Mason. "Introducing robotic origami folding". In: *IEEE International Conference on Robotics and Automation*. 2004, pp. 3245–3250.

[66] Devin Balkcom and Matthew T. Mason. "Extremal trajectories for bounded velocity mobile robots". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2002, pp. 1747–1752.

[67] Devin Balkcom, E. J. Gottlieb, and Jeffrey C. Trinkle. "A sensorless insertion strategy for rigid planar parts". In: *IEEE International Conference on Robotics and Automation (ICRA)*. Superceded by IJRR article. 2002, pp. 882–887.

[68] Devin Balkcom, Jeffrey C. Trinkle, and E. J. Gottlieb. "Computing wrench cones for planar contact tasks". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2002, pp. 869–875.

[69] Devin Balkcom and Matthew T. Mason. "Progress in desktop robotics". In: *The Eleventh Yale Workshop on Adaptive and Learning Systems*. 2001.

[70] Devin Balkcom and Matthew T. Mason. "Time optimal trajectories for bounded velocity differential drive robots". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2000, pp. 2499–2504.

[71] Devin Balkcom and Matthew T. Mason. "Extremal trajectories for bounded velocity differential drive robots". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2000, pp. 2479–2484.

TECH REPORTS AND ONLINE TEXTS

[72] Yinan Zhang, Devin J. Balkcom, and Haoxiang Li. *Towards Physically Safe Reinforcement Learning under Supervision*. arXiv. 2019. arXiv: 1901.06576.

[73] Samuel Lensgraf, Karim Itani, Yinan Zhang, Zezhou Sun, Yijia Wu, Alberto Quattrini Li, Bo Zhu, Emily Whiting, Weifu Wang, and Devin Balkcom. *PuzzleFlex: kinematic motion of chains with loose joints*. arXiv. 2019. arXiv: 1906.08708 [cs.RO].

[74] Devin Balkcom. *Project Python: an interactive introduction to Computer Science*. On-line at projectpython.net. 170 pages. 2011.

[75] Devin Balkcom and Tom Cormen. *Algorithms Tutorials*. On-line at Khan Academy. 60 pages. 2015.
[76] Devin Balkcom. *Java for coders*. On-line at www.educative.io. 22 pages. 2017.

PH.D. THESES SUPERVISED

[77] Matthew P. Bell. "Flexible Object Manipulation". PhD thesis. Hanover, NH: Dartmouth Computer Science, 2010.
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