

Scott Kuindersma

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200 Smith Street ◊ Waltham, MA 02451

CURRENT POSITION

Boston Dynamics

Atlas Project Lead

Waltham, MA

July 2018–present

ACADEMIC POSITIONS

Harvard University

Assistant Professor of Engineering and Computer Science
John A. Paulson School of Engineering and Applied Sciences

Cambridge, MA

July 2015–May 2019

Massachusetts Institute of Technology

Postdoctoral Associate, Robot Locomotion Group, CSAIL

Cambridge, MA

Sept 2012–June 2015

EDUCATION

University of Massachusetts Amherst

Doctor of Philosophy, Computer Science
Thesis: *Variable Risk Policy Search for Dynamic Robot Control*
Advisors: Roderic Grupen & Andrew Barto

Amherst, MA

Sept 2012

University of Massachusetts Amherst

Master of Science, Computer Science

Amherst, MA

Feb 2009

Bryant University

Bachelor of Science, Information Technology (Computer Science)

Smithfield, RI

May 2006

RESEARCH EXPERIENCE

Boston Dynamics

Staff Research Scientist

Leading a multidisciplinary teams of engineers to develop high-performance mobility and manipulation capabilities across multiple robot platforms.

Waltham, MA

July 2018–present

Harvard University

Director, Harvard Agile Robotics Laboratory

Leading a team of students and postdocs conducting research on planning, control, and estimation for dynamic walking, grasping, and flying robots.

Cambridge, MA

July 2015–May 2019

Massachusetts Institute of Technology

Postdoctoral Associate, Robot Locomotion Group, CSAIL

Controls Lead for the MIT DARPA Robotics Challenge team. Developed optimization-based planning and control algorithms for legged locomotion and mobile manipulation.

Cambridge, MA

Sept 2012–June 2015

University of Massachusetts Amherst

Research Assistant, Laboratory for Perceptual Robotics

Created Bayesian optimization algorithms for risk-sensitive policy search and applied them to learning dynamic controllers on the uBot-5.

Amherst, MA

June 2008–Aug 2012

NASA Johnson Space Center

Graduate Fellow Intern, Robonaut 2 Laboratory

Created a dynamic simulator for Robonaut 2 and implemented prototype zero-gravity body orientation controllers. Contributed autonomous manipulation software used on Robonaut 2.

Houston, TX

Summer 2011

NASA Johnson Space Center*Graduate Fellow Intern, Dexterous Robotics Laboratory*

Developed controllers in simulation for a humanoid designed to operate autonomously on the moon.

Houston, TX

*Summer 2010***AWARDS AND RECOGNITION**

Sony Faculty Innovation Award (one of six worldwide)	<i>Jun 2017</i>
Best 2016 Paper Award, IEEE-RAS Technical Committee on Whole-Body Control	<i>May 2017</i>
Google Faculty Research Award	<i>Feb 2017</i>
NSF CISE Research Initiation Initiative Award	<i>Jan 2017</i>
MIT Technology Review Breakthrough Technologies of 2014 (feat. our control work)	<i>Jun 2014</i>
DARPA Robotics Challenge Finalist, with Team MIT as the Controls Lead	<i>Dec 2013</i>
NASA Graduate Fellowship	<i>Sep 2009–Aug 2012</i>
Best Spotlight Talk & Electronic Poster, Robotics: Science & Systems (RSS)	<i>July 2012</i>
National ICT Australia (NICTA) Student Fellowship, RSS	<i>July 2012</i>
Best Student Video, AAAI 2011 Video Competition	<i>Aug 2011</i>
Massachusetts Space Grant Fellowship	<i>Sep 2008 & Jun 2009</i>
George J. Kelley Award, Bryant University (ranked 1 st in graduating class of over 700)	<i>May 2006</i>

TEACHING

Harvard University	Cambridge, MA
<i>Instructor, CS 182: Artificial Intelligence</i>	<i>Fall 2016-17</i>
<i>Instructor, CS 284: Optimization Algorithms for Robotics</i>	<i>Spring 2016,18</i>
<i>Guest Lecturer, Econ 1000: Growth, Technology, Inequality, Education</i>	<i>Fall 2017</i>
<i>Guest Lecturer, CS 189: Autonomous Robot Systems</i>	<i>Spring 2016</i>
<i>Guest Lecturer, ES 158: Feedback Systems</i>	<i>Fall 2015</i>
<i>Guest Lecturer, CS 182: Artificial Intelligence</i>	<i>Fall 2015</i>
Massachusetts Institute of Technology	Cambridge, MA
<i>Guest Lecturer, 6.832: Underactuated Robotics</i>	<i>Fall 2014</i>
University of Massachusetts Amherst	Amherst, MA
<i>Teaching Assistant, CS 187: Data Structures</i>	<i>Fall 2006</i>
<i>Guest Lecturer, CS 603: Robotics</i>	<i>Fall 2009</i>

ADVISING

Postdoctoral Research Fellows

Avik De (McDonnell Foundation Fellow)	<i>Jan 2019–Apr 2019</i>
Nak-seung Patrick Hyun	<i>Jun 2018–Apr 2019</i>
Ye Zhao (Next: Faculty at Georgia Tech)	<i>Nov 2016–Oct 2018</i>
Myunghee Kim (Next: Faculty at UIC)	<i>Apr 2016–Jun 2018</i>
Zachary Manchester (Next: Faculty at Stanford)	<i>Oct 2015–Dec 2017</i>

PhD Students

Neel Doshi, Electrical Engineering (co-advised w/R. Wood, Next: Postdoc @ MIT)	<i>Sep 2017–Apr 2019</i>
Patrick Varin, Computer Science	<i>Sep 2016–Present</i>
Brian Plancher, Electrical Engineering (NSF Fellow)	<i>Sep 2018–Present</i>

Masters Students

Brian Plancher, Electrical Engineering (Next: PhD @ Harvard, NSF Fellow)	<i>Sep 2016–May 2018</i>
Charles Liu, Applied Computation (Next: Google)	<i>May 2016–May 2018</i>

Undergraduate Theses Advised

John Keszler, Electrical Engineering	<i>May 2019</i>
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Nicholas Pham, Electrical Engineering	May 2019
Jenny Horing, Mechanical Engineering (Dean's Award Honorable Mention)	May 2018
Brian Krentz, Electrical Engineering (Dean's Award Honorable Mention)	May 2017
Ivan Cisneros, Electrical Engineering (Dean's Award Honorable Mention)	Dec 2016

PhD Thesis Committee: Michael Neunert (ETH, 2017), Benjamin Goldberg (Harvard, 2017), Ye Ding (Harvard, 2018), Fionnuala Connolly (Harvard, 2018), Michelle Rosen (Harvard, 2018), Albert Wang (MIT, 2019), Jan Carius (ETH, 2021), Brian Jackson (CMU, current)

JOURNAL PAPERS

1. B. Plancher, S. Neuman, T. Bourgeat, S. Kuindersma, S. Devadas, V.J. Reddi, Accelerating Robot Dynamics Gradients on a CPU, GPU, and FPGA, *Robotics and Automation Letters*, 2021.
2. N.P. Hyun, R. McGill, R. Wood, and S. Kuindersma, A New Control Framework for Flapping-Wing Vehicles based on 3D Pendulum Dynamics, *Automatica*, 2020.
3. Z. Manchester, N. Doshi, R. Wood, and S. Kuindersma, Contact-Implicit Trajectory Optimization using Variational Integrators, *International Journal of Robotics Research (IJRR)*, 38(12-13), 2019.
4. N. Doshi, K. Jayaram, S. Castellanos, S. Kuindersma, and R. Wood, Effective Locomotion Across Frequency Regimes Using Proprioceptive Feedback on a Microrobot, *Bioinspiration & Biomimetics*, 2019.
5. Z. Manchester and S. Kuindersma, Robust Direct Trajectory Optimization Using Approximate Invariant Funnels, *Autonomous Robots*, 43(2):375-387, 2018.
6. M.J. Holman, M.J. Payne, P. Blankley, R. Janssen, S. Kuindersma, HelioLinC: A Novel Approach to the Minor Planet Linking Problem, *The Astronomical Journal*, 156(3), 2018.
7. Y. Ding, M. Kim, S. Kuindersma, and C.J. Walsh, Human-in-the-loop optimization of hip assistance with a soft exosuit during walking, *Science Robotics*, 3(15): eaar5438, 2018.
8. M. Kim, Y. Ding, P. Malcolm, J. Speckaert, C. Siviyy, C. Walsh, and S. Kuindersma, Human-in-the-loop Bayesian optimization of wearable device parameters, *PLoS ONE* 12(9): e0184054, 2017.
9. P. Marion, R. Deits, A. Valenzuela, C. Perez D'Arpino, G. Izatt, L. Manuelli, M. Antone, H. Dai, T. Koolen, J. Carter, M. Fallon, S. Kuindersma, R. Tedrake. Director: A User Interface Designed for Robot Operation with Shared Autonomy, *Journal of Field Robotics*, December 2016.
10. S. Kuindersma, R. Deits, M. Fallon, A. Valenzuela, H. Dai, F. Permenter, T. Koolen, P. Marion, R. Tedrake. Optimization-based Locomotion Planning, Estimation, and Control Design for the Atlas Humanoid Robot, *Autonomous Robots*, 40(3):429-455, February 2016.
11. M. Fallon, S. Kuindersma, S. Karumanchi, M. Antone, T. Schneider, H. Dai, C. Pérez D'Arpino, R. Deits, M. DiCicco, D. Fourie, T. Koolen, P. Marion, M. Posa, A. Valenzuela, K. Yu, J. Shah, K. Iagnemma, R. Tedrake, S. Teller. An Architecture for Online Affordance-based Perception and Whole-body Planning, *Journal of Field Robotics*, 32(2):229-254, March 2015.
12. S. Kuindersma, R.A. Grupen, and A.G. Barto. Variable Risk Control via Stochastic Optimization. *International Journal of Robotics Research*, 32(7):806-825, June 2013.
13. G.D. Konidaris, S. Kuindersma, R.A. Grupen, and A.G. Barto. Robot Learning from Demonstration by Constructing Skill Trees. *International Journal of Robotics Research*, 31(3):360-375, March 2012.
14. B.S. Blais, M.Y. Frenkel, S. Kuindersma, R. Muhammad, H.Z. Shouval, L.N. Cooper, and M.F. Bear. Recovery from monocular deprivation using binocular deprivation: Experimental observations and theoretical analysis. *J Neurophysiol*, 100(4):2217-2224, October 2008.
15. S. Kuindersma and B.S. Blais. Teaching Bayesian Model Comparison With the Three-Sided Coin. *The American Statistician*, 61(3):239-244, August 2007.

CONFERENCE PAPERS

16. P. Varin, L. Grossman, and S. Kuindersma, A Comparison of Action Spaces for Learning Dynamic Manipulation Tasks, In *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, November 2019.
17. M. Kim, C. Liu, J. Kim, S. Lee, A. Meguid, C.J. Walsh, and S. Kuindersma, Bayesian Optimization of Soft Exosuits Using a Metabolic Estimator Stopping Process, In *Proceedings of the International Conference on Robotics and Automation (ICRA)*, Montreal, Canada, 2019.
18. P. Varin and S. Kuindersma, A Constrained Kalman Filter for Rigid Body Systems with Frictional Contact, *International Workshop on the Algorithmic Foundations of Robotics (WAFR)*, Merida, Mexico, 2018.
19. B. Plancher and S. Kuindersma, A Performance Analysis of Parallel Differential Dynamic Programming on a GPU, *International Workshop on the Algorithmic Foundations of Robotics (WAFR)*, Merida, Mexico, 2018.
20. N. Doshi, K. Jayaram, B. Goldberg, Z. Manchester, R. Wood, and S. Kuindersma, Contact-Implicit Optimization of Locomotion Trajectories for a Quadrupedal Microrobot, *Robotics: Science and Systems (RSS)*, Pittsburgh, PA, 2018.
21. Z. Manchester and S. Kuindersma, Variational Contact-Implicit Trajectory Optimization, In *Proceedings of the International Symposium on Robotics Research (ISRR)*, Puerto Varas, Chile, 2017.
22. B. Plancher, Z. Manchester, and S. Kuindersma, Constrained Unscented Dynamic Programming, In *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Vancouver, BC, September 2017.
23. Z. Manchester and S. Kuindersma, DIRTREL: Robust Trajectory Optimization with Ellipsoidal Disturbances and LQR Feedback, *Robotics: Science and Systems (RSS)*, Cambridge, MA, 2017.
24. Z. Manchester, J. I. Lipton, R. J. Wood, and S. Kuindersma, A Variable Forward-Sweep Wing Design for Improved Perching in Micro Aerial Vehicles, In *Proceedings of the 55th AIAA Aerospace Sciences Meeting, AIAA SciTech Forum*, January 2017.
25. Z. Manchester and S. Kuindersma. Derivative-Free Trajectory Optimization using Unscented Dynamic Programming, In *Proceedings of the 55th Conference on Decision and Control (CDC)*, Las Vegas, NV, December 2016.
26. M. Posa, S. Kuindersma, R. Tedrake. Optimization and stabilization of trajectories for constrained dynamical systems, In *Proceedings of the International Conference on Robotics and Automation (ICRA)*, Stockholm, Sweden, May 2016.
27. R. Tedrake, S. Kuindersma, R. Deits, K. Miura. A closed-form solution for real-time ZMP gait generation and feedback stabilization, In *Proceedings of the International Conference on Humanoid Robotics*, October 2015.
28. S. Kuindersma, F. Permenter, and R. Tedrake. An Efficiently Solvable Quadratic Program for Stabilizing Dynamic Locomotion. In *Proceedings of the International Conference on Robotics and Automation (ICRA)*, Hong Kong, China, May 2014.
29. S. Kuindersma, R.A. Grupen, and A.G. Barto. Variational Bayesian Optimization for Runtime Risk-Sensitive Control. In *Robotics: Science and Systems VIII (RSS)*, Sydney, Australia, July 2012.
30. S. Kuindersma, R.A. Grupen, and A.G. Barto. Learning Dynamic Arm Motions for Postural Recovery. In *Proceedings of the 11th IEEE-RAS International Conference on Humanoid Robots*, Bled, Slovenia, October 2011. *Selected for oral presentation.*
31. G.D. Konidaris, S. Kuindersma, R.A. Grupen, and A.G. Barto. Autonomous Skill Acquisition on a Mobile Manipulator. In *Proceedings of the 25th Conference on Artificial Intelligence (AAAI-11)*, San Francisco, CA, August 2011.
32. G.D. Konidaris, S. Kuindersma, A.G. Barto, and R.A. Grupen. Constructing Skill Trees for Rein-

forcement Learning Agents from Demonstration Trajectories. In *Advances in Neural Information Processing Systems 23 (NIPS)*, Vancouver, BC, December 2010.

33. S. Kuindersma, E. Hannigan, D. Ruiken, and R.A. Grupen. Dexterous Mobility with the uBot-5 Mobile Manipulator. In *Proceedings of the 14th International Conference on Advanced Robotics*, Munich, Germany, June 2009.

WORKSHOP PAPERS AND ABSTRACTS

34. N. Doshi, K. Jayaram, B. Goldberg, Z. Manchester, R. Wood, and S. Kuindersma, Contact-Implicit Optimization of Locomotion Trajectories for a Quadrupedal Microrobot, *Dynamic Walking*, Pensacola, Florida, May 2018.
35. Z. Manchester and S. Kuindersma. Variational Contact-Implicit Trajectory Optimization, (extended abstract), In *RSS 2017 Workshop on Revisiting Contact*, Cambridge, MA, July 2017.
36. M. Posa, S. Kuindersma, R. Tedrake. Whole-Body Dynamic Planning and Stabilization with Contact. *Dynamic Walking*, Columbus, Ohio, July 2015.
37. R. Tedrake, M. Fallon, S. Karumanchi, S. Kuindersma, M. Antone, T. Schneider, T. Howard, M. Walter, H. Dai, R. Deits, M. Fleder, D. Fourie, R. Hammoud, S. Hemachandra, P. Iardi, C. Perez-D'Arpino, S. Pillai, A. Valenzuela, C. Cantu, C. Dolan, I. Evans, S. Jorgensen, J. Kristeller, J. Shah, K. Iagnemma, S. Teller. A Summary of Team MIT's Approach to the Virtual Robotics Challenge. In *Proceedings of the International Conference on Robotics and Automation (ICRA)*, Hong Kong, China, May 2014.
38. G.D. Konidaris, S. Kuindersma, S. Niekum, R.A. Grupen, and A.G. Barto. Robot Learning: Some Recent Examples. In *Proceedings of the Sixteenth Yale Workshop on Adaptive and Learning Systems*, Yale University, New Haven CT, June 2013.
39. S. Kuindersma, R.A. Grupen, and A.G. Barto. Learning to Exploit Dynamics with Variable Risk Policy Search. In *RSS 2012 Workshop on Biologically-Inspired Robotics*, Sydney, Australia, July 2012.
40. S. Kuindersma, R.A. Grupen, and A.G. Barto. Variable Risk Dynamic Mobile Manipulation. In *RSS 2012 Mobile Manipulation Workshop*, Sydney, Australia, July 2012.
41. G.D. Konidaris, S. Kuindersma, R.A. Grupen, and A.G. Barto. CST: Constructing Skill Trees by Demonstration. In *Proceedings of the ICML Workshop on New Developments in Imitation Learning*, Bellevue, WA, July 2011.
42. G.D. Konidaris, S. Kuindersma, R.A. Grupen, and A.G. Barto. Acquiring Transferrable Mobile Manipulation Skills. In *RSS 2011 Workshop on Mobile Manipulation: Learning to Manipulate*, Los Angeles, CA, June 2011.
43. S. Kuindersma, G.D. Konidaris, R.A. Grupen, and A.G. Barto. Learning from a Single Demonstration: Motion Planning with Skill Segmentation. In *NIPS Workshop on Learning and Planning from Batch Time Series Data*, Whistler, BC, December 2010.
44. S. Kuindersma. Control Model Learning for Whole-Body Mobile Manipulation (extended abstract). In *Proceedings of the Twenty-Fourth Conference on Artificial Intelligence (AAAI-10)*, Atlanta, GA, July 2010.
45. B.S. Blais and S. Kuindersma. A Hierarchical Spatiotemporal Model of Neocortex with Probabilistic Feedback. In *Proceedings of the 12th International Conference on Cognitive and Neural Systems (ICCN 2008)*, Boston, MA, May 2008.
46. B.S. Blais and S. Kuindersma. Developing receptive fields in spiking-rate models of synaptic plasticity. In *Society for Neuroscience Conference Abstracts*, Washington, DC, November 2005.
47. B.S. Blais, M.Y. Frenkel, S. Kuindersma, and M.F. Bear. Exploring the roles of structure and noise in the mouse visual system. In *Proceedings of the 9th International Conference on Cognitive and*

THESES AND BOOK CHAPTERS

48. P. Marion, M. Fallon, R. Deits, A. Valenzuela, C. Perez D'Arpino, G. Izatt, L. Manuelli, M. Antone, H. Dai, T. Koolen, J. Carter, S. Kuindersma, R. Tedrake. Director: A User Interface Designed for Robot Operation with Shared Autonomy, In *The DARPA Robotics Challenge Finals: Humanoid Robots To The Rescue*. Springer Tracts in Advanced Robotics, vol 121, pp 237–270.
49. P.-B. Wieber, R. Tedrake, and S. Kuindersma. Modeling and Control of Legged Systems, *Springer Handbook of Robotics, 2nd Ed.*, 2016.
50. S. Kuindersma. Variable Risk Policy Search for Dynamic Robot Control. PhD Thesis, Department of Computer Science, University of Massachusetts Amherst, September 2012.

TECHNICAL REPORTS

51. S. Kuindersma, R.A. Grupen, and A.G. Barto. Episodic Risk-Sensitive Actor-Critic. Technical Report UM-CS-2012-017, Department of Computer Science, University of Massachusetts Amherst, June 2012.

INVITED TALKS AND PANELS

Humanoids Workshop on Superhuman Abilities in Current Humanoids	<i>Jul 2021</i>
RSS Workshop on Software Tools for Realtime Optimal Control	<i>Jul 2021</i>
NeurIPS Workshop on Challenges of Real-World RL	<i>Dec 2020</i>
Robotics Today, https://roboticstoday.github.io/	<i>June 2020</i>
MIT, Second Annual Summer School on Cognitive Robotics, Cambridge, MA	<i>July 2018</i>
Panel Chair, NSF Smart and Autonomous Systems PI Meeting	<i>Apr 2018</i>
Mathematical Biosciences Institute, Ohio State University, Columbus, OH	<i>Nov 2017</i>
IROS-17 Workshop on Planning Legged and Aerial Locomotion, Vancouver, BC	<i>Sept 2017</i>
MIT, First Annual Summer School on Cognitive Robotics, Cambridge, MA	<i>June 2017</i>
Johns Hopkins Applied Physics Laboratory, Baltimore, MD	<i>April 2017</i>
ETH Zurich, DLMC, Switzerland	<i>July 2016</i>
ICML Workshop on On-Device Intelligence, New York, NY	<i>June 2016</i>
Boston Dynamics, Waltham, MA	<i>March 2016</i>
Infors Optimization Society Conference, Princeton University	<i>March 2016</i>
Northeast Robotics Colloquium (Keynote), WPI, Worcester, MA	<i>Nov 2015</i>
University of Washington, Computer Science and Engineering Colloquium	<i>March 2015</i>
Harvard University, SEAS Seminar	<i>March 2015</i>
Georgia Institute of Technology, Interactive Computing Seminar	<i>March 2015</i>
California Institute of Technology, Mechanical and Civil Engineering Seminar	<i>March 2015</i>
Worcester Polytechnic Institute, Robotics Engineering Colloquium	<i>Feb 2015</i>
University of Massachusetts Amherst, Computer Science Seminar	<i>Feb 2015</i>
Boston University, Mechanical Engineering Seminar	<i>Feb 2015</i>
Northeastern University, Computer and Information Science Colloquium	<i>Feb 2015</i>
University of Michigan, Engineering Seminar, Ann Arbor, MI	<i>Sept 2014</i>
Panelist, NASA Blue Sky Meeting on Robotics for Exploration Missions, Pensacola, FL	<i>Sept 2014</i>
RSS Workshop on Dynamic Locomotion, Berkeley, CA	<i>July 2014</i>
ICRA Workshop on Hydraulic Robots, Hong Kong, China	<i>June 2014</i>
IHMC Workshop on Humanoid Control	<i>March 2014</i>
RSS Workshop on the Virtual Robotics Challenge, Berlin	<i>June 2013</i>
MIT, CSAIL Seminar, Cambridge, MA	<i>Aug 2012</i>
University of Texas at Austin, Mechanical Engineering Seminar, Austin, TX	<i>June 2012</i>

PROFESSIONAL SERVICE

- *Publication Chair*: Robotics: Science and Systems (RSS), 2017
- *Co-organizer*: RSS-17 Workshop on Challenges in Dynamic Legged Locomotion; Humanoids-15 Workshop on Reusable and Open-Source Modules for Humanoid Robots; RSS-14 Workshop on the DARPA Robotics Challenge
- *Editor*: IJRR Special Issue on Robotics: Science and Systems 2017
- *Associate Editor*: BioRob-18, ICRA-17, HUMANOIDS 2015–17
- *Assistant Editor*: Robotics & Autonomous Systems, 2009–2013
- *Senior Program Committee*: IJCAI-15
- *Program Committee*: RSS-17–18, WAFR-16, AAAI-17 Video Awards, AAAI-13, IJCAI-13, NEMS-10
- *NSF Panelist*: Fall 2017
- *Journal/book chapter reviewing*: IJRR, IEEE TRO, Autonomous Robots, Journal of Field Robotics, JAIR, JMLR, IEEE Transactions on Mechatronics, Robotics & Autonomous Systems, IEEE Robotics and Automation Letters, Neural Computation, Geometric and Numerical Foundations of Movement, Journal of Aerospace Science and Technology
- *Conference reviewing*: ICRA, IROS, WAFR, RSS, Humanoids, ISRR, AAAI, IJCAI, AAAI SSS, Control of Cyber-Physical Systems, NESCAI
- *Book proposal reviewing*: MIT Press, CRC Press
- *Student Volunteer*: AAAI-11
- *Member*: AAAS, IEEE, ACM, IEEE Controls Society, IEEE Robotics and Automation Society (RAS), IEEE Technical Committee on Cyber Physical Systems, IEEE-RAS Technical Committees on Mobile Manipulation, Whole-Body Control, and Model-Based Optimization for Robotics