

Ron Alterovitz, Ph.D.

Professor
Department of Computer Science
University of North Carolina at Chapel Hill
August 2, 2018

223 Sitterson Hall
Campus Box 3175
Chapel Hill, NC 27599-3175

(919) 590-6068
ron@cs.unc.edu
www.cs.unc.edu/~ron

EDUCATION

University of California, Berkeley

Ph.D., Industrial Engineering and Operations Research, 2006

Thesis: *Planning and Optimization Algorithms for Image-Guided Medical Procedures*

Committee: Ken Goldberg (Chair), James F. O'Brien, Alper Atamtürk, and Jean Pouliot

University of California, Berkeley

M.S., Industrial Engineering and Operations Research, 2003

California Institute of Technology (Caltech)

B.S. with Honors, Engineering and Applied Science (emphasis on Computer Science), 2001

PROFESSIONAL EXPERIENCE

- 2018–present *Professor (with Tenure)*, **University of North Carolina at Chapel Hill**,
Department of Computer Science
- 2015–2018 *Associate Professor (with Tenure)*, **University of North Carolina at Chapel Hill**,
Department of Computer Science
- 2009–2014 *Assistant Professor*, **University of North Carolina at Chapel Hill**, Department
of Computer Science
- 2007–2008 *NIH Postdoctoral Research Fellow*, **University of California, San Francisco**,
UCSF Comprehensive Cancer Center, and **University of California, Berkeley**,
Department of Electrical Engineering and Computer Sciences
- 2006–2007 *Postdoctoral Research Fellow*, **LAAS-CNRS (National Center for Scientific
Research)**, Toulouse, France, Robotics and Artificial Intelligence Group
- 2005 *Graduate Student Instructor*, **University of California, Berkeley**, Department
of Electrical Engineering and Computer Sciences
- 2001–2006 *Graduate Student Researcher*, **University of California, Berkeley**, Berkeley
Automation Sciences Laboratory
- 2000 *Software Developer*, **Oracle Corporation**
- 1999 *Software Developer*, **Netscape Communications**
- 1997, 1998 *Research Intern*, **NASA Glenn Research Center**

HONORS

- 2017 Best Paper Award, Robotics: Science and Systems Conference

- 2015 Best Paper Award, Medical Image Understanding and Analysis Conference
- 2015 Best Oral Presentation Award for paper presented by co-author, Hamlyn Symposium on Medical Robotics
- 2015 Paper from 2007 ranked in top 20 most cited papers from the last 10 years of the Robotics: Science and Systems (RSS) Conference
- 2012 National Science Foundation (NSF) CAREER Award
- 2010, 2013 UNC Computer Science Students Association (CSSA) Teaching Award
- 2009 “Highly Accessed” designation for article in BMC Bioinformatics journal
- 2009 Finalist for Intuitive Surgical Best Paper Award, IEEE International Conference on Robotics and Automation
- 2007 National Institutes of Health (NIH) Ruth L. Kirschstein National Research Service Award
- 2006 Department of Defense (DOD) Prostate Cancer Research Fellowship (declined)
- 2003 Best Paper Award Finalist, IEEE/RSJ International Conference on Intelligent Robots and Systems (one of 7 finalists/1,000+ submissions)
- 2003–2006 National Science Foundation (NSF) Graduate Research Fellowship
- 2001–2003 National Defense Science and Engineering Graduate (NDSEG) Fellowship
- 2000–2001 Caltech Upper Class Merit Award full tuition scholarship
- 2001 Sigma Xi, The Scientific Research Society
- 2000 Tau Beta Pi National Engineering Honor Society

BIBLIOGRAPHY

BOOKS

1. Ron Alterovitz and Ken Goldberg, *Motion Planning in Medicine: Optimization and Simulation Algorithms for Image-Guided Procedures*, Springer Tracts in Advanced Robotics, Berlin, Germany: Springer, 2008.

BOOK CHAPTERS AND INVITED ARTICLES

1. Arthur W. Mahoney, Trevor L. Bruns, Ron Alterovitz, and Robert J. Webster III, “Design, Sensing, and Planning: Fundamentally Coupled Problems for Continuum Robots,” in *Robotics Research*, vol. 1, A. Bicchi and W. Burgard, Eds., Springer, 2015, pp. 267–282.
2. Noah J. Cowan, Ken Goldberg, Gregory S. Chirikjian, Gabor Fichtinger, Ron Alterovitz, Kyle B. Reed, Vinutha Kallem, Wooram Park, Sarthak Misra, and Allison M. Okamura, “Robotic Needle Steering: Design, Modeling, Planning, and Image Guidance,” in *Surgical Robotics: System Applications and Visions*, J. Rosen, B. Hannaford, and R. M. Satava, Eds., Springer, 2011, pp. 557–582.
3. Ron Alterovitz and Jaydev P. Desai, “Surgical Robotics,” *IEEE Robotics and Automation Magazine*, vol. 16, no. 2, pp. 16–17, June 2009.

REFEREED JOURNAL ARTICLES

1. Cenk Baykal, Chris Bowen, and Ron Alterovitz, “Asymptotically Optimal Kinematic Design of Robots using Motion Planning,” *Autonomous Robots*, 2018.
2. Chris Bowen and Ron Alterovitz, “Closed-loop Global Motion Planning for Reactive, Collision-free Execution of Learned Tasks,” *ACM Transactions on Human-Robot Interaction*, vol. 7, no. 1, pp. 10:1–10:16, May 2018.
(One of four papers selected by the journal for oral presentation at the 2018 ACM/IEEE International Conference on Human-Robot Interaction (HRI))
3. Philip J. Swaney, Arthur W. Mahoney, Bryan I. Hartley, Andria A. Ramirez, Erik Lamers, Richard H. Feins, Ron Alterovitz, and Robert J. Webster III, “Toward Transoral Peripheral Lung Access: Combining Continuum Robots and Steerable Needles,” *Journal of Medical Robotics Research*, vol. 2, no. 1, pp. 1–14, 2017.
4. Ron Alterovitz, Sven Koenig, and Max Likhachev, “Robot Planning in the Real World: Research Challenges and Opportunities,” *AI Magazine*, vol. 37, no. 2, pp. 76–84, Summer 2016.
5. Chris Bowen and Ron Alterovitz, “Asymptotically Optimal Motion Planning for Tasks Using Learned Virtual Landmarks,” *IEEE Robotics and Automation Letters*, vol. 1, no. 2, pp. 1036–1043, July 2016. [presented at the *International Conference on Robotics and Automation (ICRA)*, 2016]
6. Momen Abayazid, Claudio Pacchierotti, Pedro Moreira, Ron Alterovitz, Domenico Praticchizzo, and Sarthak Misra, “Experimental Evaluation of Co-manipulated Ultrasound-guided Flexible Needle Steering,” *International Journal of Medical Robotics and Computer Assisted Surgery*, vol. 12, no. 2, pp. 219–230, June 2016.
7. Wen Sun, Jur van den Berg, and Ron Alterovitz, “Stochastic Extended LQR for Optimization-based Motion Planning Under Uncertainty,” *IEEE Transactions on Automation Science and Engineering*, vol. 13, no. 2, pp. 437–447, Apr. 2016.
8. Raul Wirz, Luis G. Torres, Philip J. Swaney, Hunter Gilbert, Ron Alterovitz, Robert J. Webster III, Kyle D. Weaver, and Paul T. Russell III, “An Experimental Feasibility Study on Robotic Endonasal Telesurgery,” *Neurosurgery*, vol. 76, no. 4, pp. 479–484, Apr. 2015.
9. Wen Sun, Sachin Patil, and Ron Alterovitz, “High-Frequency Replanning under Uncertainty using Parallel Sampling-Based Motion Planning,” *IEEE Transactions on Robotics*, vol. 31, no. 1, pp. 104–116, Feb. 2015.
10. Ken Goldberg, Siamak Faridani, and Ron Alterovitz, “Two Large Open-Access Datasets for Fitts’ Law of Human Motion and a Succinct Derivation of the Square-Root Variant,” *IEEE Transactions on Human-Machine Systems*, vol. 45, no. 1, pp. 62–73, Feb. 2015.
11. Chris Bowen, Gu Ye, and Ron Alterovitz, “Asymptotically-Optimal Motion Planning for Learned Tasks Using Time-Dependent Cost Maps,” *IEEE Transactions on Automation Science and Engineering*, vol. 12, no. 1, pp. 171–182, Jan. 2015.
12. Momen Abayazid, Pedro Moreira, Navid Shahriari, Sachin Patil, Ron Alterovitz, and Sarthak Misra, “Ultrasound-Guided Three-Dimensional Needle Steering in Biological Tissue with Curved Surfaces,” *Medical Engineering & Physics*, vol. 37, pp. 145–150, Jan. 2015.

13. Momen Abayazid, Gustaaf J. Vrooijink, Sachin Patil, Ron Alterovitz, and Sarthak Misra, "Experimental Evaluation of Ultrasound-Guided 3D Needle Steering in Biological Tissue," *International Journal of Computer Assisted Radiology and Surgery*, vol. 9, no. 6, pp. 931–939, Nov. 2014.
14. Jeffrey Ichnowski and Ron Alterovitz, "Scalable Multicore Motion Planning Using Lock-Free Concurrency," *IEEE Transactions on Robotics*, vol. 30, no. 5, pp. 1123–1136, Oct. 2014.
15. Gustaaf J. Vrooijink, Momen Abayazid, Sachin Patil, Ron Alterovitz, and Sarthak Misra, "Needle Path Planning and Steering in a Three-Dimensional Non-Static Environment using Two-Dimensional Ultrasound Images," *International Journal of Robotics Research*, vol. 33, no. 10, pp. 1361–1374, Sep. 2014.
16. Sachin Patil, Jessica Burgner, Robert J. Webster III, and Ron Alterovitz, "Needle Steering in 3-D via Rapid Replanning," *IEEE Transactions on Robotics*, vol. 30, no. 4, pp. 853–864, Aug. 2014.
17. Jur van den Berg, Sachin Patil, and Ron Alterovitz, "Motion Planning Under Uncertainty Using Iterative Local Optimization in Belief Space," *International Journal of Robotics Research*, vol. 31, no. 11, pp. 1263–1278, Sep. 2012.
18. Kyle B. Reed, Ann Majewicz, Vinutha Kallem, Ron Alterovitz, Ken Goldberg, Noah J. Cowan, and Allison M. Okamura, "Robot-Assisted Needle Steering," *IEEE Robotics and Automation Magazine*, vol. 18, pp. 35–46, Dec. 2011.
19. Vincent Duindam, Jijie Xu, Ron Alterovitz, Shankar Sastry, and Ken Goldberg, "Three-dimensional Motion Planning Algorithms for Steerable Needles Using Inverse Kinematics," *International Journal of Robotics Research*, vol. 29, no. 7, pp. 789–800, June 2010.
20. Nuttapong Chentanez, Ron Alterovitz, Daniel Ritchie, Jonha Cho, Kris Hauser, Ken Goldberg, Jonathan R. Shewchuk, and James F. O'Brien, "Interactive Simulation of Surgical Needle Insertion and Steering," *ACM Transactions on Graphics (Proc. SIGGRAPH)*, vol. 28, no. 3, pp. 88:1–88:10, Aug. 2009.
(Image from article featured on back cover)
21. Ron Alterovitz, Aaron Arvey, Sriram Sankararaman, Carolina Dallett, Yoav Freund, and Kimmen Sjölander, "ResBoost: Characterizing and Predicting Catalytic Residues in Enzymes," *BMC Bioinformatics*, vol. 10, no. 197, pp. 1–14, June 2009.
(Designated as "Highly accessed" by BMC Bioinformatics)
22. Ron Alterovitz, Ken Goldberg, Jean Pouliot, and I-Chow Hsu, "Sensorless Motion Planning for Medical Needle Insertion in Deformable Tissues," *IEEE Transactions on Information Technology in Biomedicine*, vol. 13, no. 2, pp. 217–225, Mar. 2009.
23. Ron Alterovitz, Michael Branicky, and Ken Goldberg, "Motion Planning Under Uncertainty for Image-Guided Medical Needle Steering," *International Journal of Robotics Research*, vol. 27, no. 11–12, pp. 1361–1374, Nov. 2008.
24. Ron Alterovitz, Etienne Lessard, Jean Pouliot, I-Chow Hsu, James F. O'Brien, and Ken Goldberg, "Optimization of HDR Brachytherapy Dose Distributions Using Linear Programming with Penalty Costs," *Medical Physics*, vol. 33, no. 11, pp. 4012–4019, Nov. 2006.

25. Ron Alterovitz, Ken Goldberg, Jean Pouliot, I-Chow Hsu, Yongbok Kim, Susan Moyher Noworolski, and John Kurhanewicz, “Registration of MR Prostate Images with Biomechanical Modeling and Nonlinear Parameter Estimation,” *Medical Physics*, vol. 33, no. 2, pp. 446–454, Feb. 2006.

REFEREED CONFERENCE ARTICLES

1. Patrick Anderson, Tayfun Ertop, Alan Kuntz, Fabien Maldonado, Ron Alterovitz, and Robert J. Webster III, “Sand Blasting Inside a Patient: A CRISP Robot for Spraying Powder inside the Chest Cavity to Preclude Lung Collapse,” in *Hamlyn Symposium on Medical Robotics*, June 2018, pp. 121–122.
2. Alan Kuntz, Chris Bowen, Cenk Baykal, Arthur W. Mahoney, Patrick L. Anderson, Fabien Maldonado, Robert J. Webster III, and Ron Alterovitz, “Kinematic Design Optimization of a Parallel Surgical Robot to Maximize Anatomical Visibility via Motion Planning,” in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2018, pp. 926–933.
3. Chris Bowen and Ron Alterovitz, “Accelerating Motion Planning for Learned Mobile Manipulation Tasks using Task-Guided Gibbs Sampling,” in *Proc. International Symposium on Robotics Research (ISRR)*, Dec. 2017, pp. 1–16.
4. Jeffrey Ichnowski, Jan Prins, and Ron Alterovitz, “The Economic Case for Cloud-based Computation for Robot Motion Planning,” in *Proc. International Symposium on Robotics Research (ISRR)*, Dec. 2017, pp. 1–7.
5. Alan Kuntz, Chris Bowen, and Ron Alterovitz, “Fast Anytime Motion Planning in Point Clouds by Interleaving Sampling and Interior Point Optimization,” in *Proc. International Symposium on Robotics Research (ISRR)*, Dec. 2017, pp. 1–16.
6. Alan Kuntz, Arthur W. Mahoney, Nicolas E. Peckman, Patrick L. Anderson, Fabien Maldonado, Robert J. Webster III, and Ron Alterovitz, “Motion Planning for Continuum Reconfigurable Incisionless Surgical Parallel Robots,” in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Sep. 2017, pp. 6463–6469.
7. Cenk Baykal and Ron Alterovitz, “Asymptotically Optimal Design of Piecewise Cylindrical Robots using Motion Planning,” in *Proc. Robotics: Science and Systems (RSS)*, July 2017, pp. 1–10.
(**Best Paper Award**)
8. Qingyu Zhao, Stephen Pizer, Ron Alterovitz, Marc Niethammer, and Julian Rosenman, “Orthotropic Thin Shell Elasticity Estimation for Surface Registration,” in *Proc. Information Processing in Medical Imaging (IPMI)*, June 2017, pp. 493–504.
9. Jeffrey Ichnowski, Jan Prins, and Ron Alterovitz, “Cloud-based Motion Plan Computation for Power-Constrained Robots,” in *Algorithmic Foundations of Robotics (WAFR 2016)*, Dec. 2016, pp. 1–16.
10. Qingyu Zhao, True Price, Stephen Pizer, Marc Niethammer, Ron Alterovitz, and Julian Rosenman, “The Endoscopogram: A 3D Model Reconstructed from Endoscopic Video Frames,” in *Medical Image Computing and Computer Assisted Intervention (MICCAI)*, Oct. 2016, pp. 439–447.
(**Selected for oral presentation; only 5.0% of submissions presented orally**)

11. Alan Kuntz, Philip J. Swaney, Arthur W. Mahoney, Richard H. Feins, Yueh Z. Lee, Robert J. Webster III, and Ron Alterovitz, "Toward Transoral Peripheral Lung Access: Steering Bronchoscope-deployed Needles through Porcine Lung Tissue," in *Hamlyn Symposium on Medical Robotics*, June 2016, pp. 9–10.
12. Alan Kuntz, Luis G. Torres, Richard H. Feins, Robert J. Webster III, and Ron Alterovitz, "Motion Planning for a Three-Stage Multilumen Transoral Lung Access System," in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Sep. 2015, pp. 3255–3261.
13. Cenk Baykal, Luis G. Torres, and Ron Alterovitz, "Optimizing Design Parameters for Sets of Concentric Tube Robots using Sampling-based Motion Planning," in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Sep. 2015, pp. 4381–4387.
14. Qingyu Zhao, James Price, Stephen Pizer, Marc Niethammer, Ron Alterovitz, and Julian Rosenman, "Surface Registration in the Presence of Missing Patches and Topology Change," in *Proc. Medical Image Understanding and Analysis*, July 2015, pp. 8–13.
(**Best Paper Award**)
15. Philip J. Swaney, Hunter B. Gilbert, Richard J. Hendrick, Oliver Commichau, Ron Alterovitz, and Robert J. Webster III, "Transoral Steerable Needles in the Lung: How Non-annular Concentric Tube Robots Can Improve Targeting," in *Hamlyn Symposium on Medical Robotics*, June 2015, pp. 37–38.
(**Best Oral Presentation**)
16. Luis G. Torres, Alan Kuntz, Hunter B. Gilbert, Philip J. Swaney, Richard J. Hendrick, Robert J. Webster III, and Ron Alterovitz, "A Motion Planning Approach to Automatic Obstacle Avoidance during Concentric Tube Robot Teleoperation," in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2015, pp. 2361–2367.
17. Philip J. Swaney, Arthur W. Mahoney, Andria A. Ramirez, Erik Lamers, Bryan I. Hartley, Richard H. Feins, Ron Alterovitz, and Robert J. Webster III, "Tendons, Concentric Tubes, and a Bevel Tip: Three Steerable Robots in One Transoral Lung Access System," in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2015, pp. 5378–5383.
18. Chris Bowen and Ron Alterovitz, "Closed-Loop Global Motion Planning for Reactive Execution of Learned Tasks," in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Sep. 2014, pp. 1754–1760.
19. Wen Sun and Ron Alterovitz, "Motion Planning under Uncertainty for Medical Needle Steering Using Optimization in Belief Space," in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Sep. 2014, pp. 1775–1781.
20. Jeffrey Ichnowski and Ron Alterovitz, "Fast Nearest Neighbor Search in SE(3) for Sampling-Based Motion Planning," in *Algorithmic Foundations of Robotics XI (WAFR 2014)*, H. L. Akin et al. (Eds.), STAR vol. 107, Springer, Aug. 2014, pp. 197–214.
21. Wen Sun, Jur van den Berg, and Ron Alterovitz, "Stochastic Extended LQR: Optimization-based Motion Planning Under Uncertainty," in *Algorithmic Foundations of Robotics XI (WAFR 2014)*, H. L. Akin et al. (Eds.), STAR vol. 107, Springer, Aug. 2014, pp. 609–626.

22. Luis G. Torres, Cenk Baykal, and Ron Alterovitz, “Interactive-rate Motion Planning for Concentric Tube Robots,” in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2014, pp. 1915–1921.
23. Jeffrey Ichnowski, Jan F. Prins, and Ron Alterovitz, “Cache-Aware Asymptotically-Optimal Sampling-Based Motion Planning,” in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2014, pp. 5804–5810.
24. Wen Sun, Islam S. M. Khalil, Sarthak Misra, and Ron Alterovitz, “Motion Planning for Paramagnetic Microparticles Under Motion and Sensing Uncertainty,” in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2014, pp. 5811–5817.
25. Pedro Moreira, Sachin Patil, Ron Alterovitz, and Sarthak Misra, “Needle Steering in Biological Tissue using Ultrasound-based Online Curvature Estimation,” in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2014, pp. 4368–4373.
26. Wen Sun, Luis G. Torres, Jur van den Berg, and Ron Alterovitz, “Safe Motion Planning for Imprecise Robotic Manipulators by Minimizing Probability of Collision,” in *Proc. International Symposium on Robotics Research (ISRR)*, Dec. 2013, pp. 685–701.
27. Edgar Lobaton, Jinghua Fu, Luis G. Torres, and Ron Alterovitz, “Continuous Shape Estimation of Continuum Robots Using X-ray Images,” in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2013, pp. 717–724.
28. Luis G. Torres, Robert J. Webster III, and Ron Alterovitz, “Task-oriented Design of Concentric Tube Robots using Mechanics-based Models,” in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2012, pp. 4449–4455.
29. Jeffrey Ichnowski and Ron Alterovitz, “Parallel Sampling-Based Motion Planning with Superlinear Speedup,” in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2012, pp. 1206–1212.
30. Jur van den Berg, Sachin Patil, and Ron Alterovitz, “Efficient Approximate Value Iteration for Continuous Gaussian POMDPs,” in *Proc. Twenty-Sixth AAAI Conference (AAAI-12)*, July 2012, pp. 1832–1838.
31. Sachin Patil, Jur van den Berg, and Ron Alterovitz, “Estimating Probability of Collision for Safe Planning under Gaussian Motion and Sensing Uncertainty,” in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2012, pp. 3238–3244.
32. Edgar Lobaton, Ram Vasudevan, Ron Alterovitz, and Ruzena Bajcsy, “Robust Topological Features for Deformation Invariant Image Matching,” in *Proc. International Conference on Computer Vision (ICCV)*, Nov. 2011, pp. 2516–2523.
33. Luis G. Torres and Ron Alterovitz, “Motion Planning for Concentric Tube Robots Using Mechanics-based Models,” in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Sept. 2011, pp. 5153–5159.
34. Jur van den Berg, Sachin Patil, and Ron Alterovitz, “Motion Planning under Uncertainty using Differential Dynamic Programming in Belief Space,” in *Proc. International Symposium on Robotics Research (ISRR)*, Aug. 2011, pp. 473–490.
35. Gu Ye and Ron Alterovitz, “Demonstration-Guided Motion Planning,” in *Proc. International Symposium on Robotics Research (ISRR)*, Aug. 2011, pp. 291–307.

36. Sachin Patil, Jur van den Berg, and Ron Alterovitz, "Motion Planning Under Uncertainty in Highly Deformable Environments," in *Proc. Robotics: Science and Systems (RSS)*, June 2011, pp. 1–8.
37. Edgar Lobaton, Jinghe Zhang, Sachin Patil, and Ron Alterovitz, "Planning Curvature-Constrained Paths to Multiple Goals Using Circle Sampling," in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2011, pp. 1463–1469.
38. Ron Alterovitz, Sachin Patil, and Anna Derbakova, "Rapidly-Exploring Roadmaps: Weighing Exploration vs. Refinement in Optimal Motion Planning," in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2011, pp. 3706–3712.
39. Jur van den Berg, Sachin Patil, Ron Alterovitz, Pieter Abbeel, and Ken Goldberg, "LQG-Based Planning, Sensing, and Control of Steerable Needles," in *Algorithmic Foundations of Robotics IX (WAFR 2010)*, D. Hsu et al. (Eds.), STAR vol. 68, Springer-Verlag, 2010, pp. 373–389.
40. Sachin Patil and Ron Alterovitz, "Interactive Motion Planning for Steerable Needles in 3D Environments with Obstacles," in *Proc. IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)*, Sep. 2010, pp. 893–899.
41. Edgar Lobaton, Ram Vasudevan, Ruzena Bajcsy, and Ron Alterovitz, "Local Occlusion Detection Under Deformations Using Topological Invariants," in *Proc. European Conference on Computer Vision (ECCV)*, Lecture Notes in Computer Science 6313, Sep. 2010, pp. 101–114.
(Selected for oral presentation; only 3.2% of submissions presented orally)
42. Lisa A. Lyons, Robert J. Webster III, and Ron Alterovitz, "Planning Active Cannula Configurations Through Tubular Anatomy," in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2010, pp. 2082–2087.
43. Sachin Patil and Ron Alterovitz, "Toward Automated Tissue Retraction in Robot-Assisted Surgery," in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2010, pp. 2088–2094.
44. Lisa A. Lyons, Robert J. Webster III, and Ron Alterovitz, "Motion Planning for Active Cannulas," in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2009, pp. 801–806.
45. Jijie Xu, Vincent Duindam, Ron Alterovitz, Jean Pouliot, J. Adam M. Cunha, I-Chow Hsu, and Ken Goldberg, "Planning Fireworks Trajectories for Steerable Medical Needles to Reduce Patient Trauma," in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2009, pp. 4517–4522.
46. Kris Hauser, Ron Alterovitz, Nuttapong Chentanez, Allison Okamura, and Ken Goldberg, "Feedback Control for Steering Needles Through 3D Deformable Tissue Using Helical Paths," in *Proc. Robotics: Science and Systems (RSS)*, 2009, pp. 1–8.
47. Meysam Torabi, Kris Hauser, Ron Alterovitz, Vincent Duindam, and Ken Goldberg, "Guiding Medical Needles Using Single-Point Tissue Manipulation," in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2009, pp. 2705–2710.
(Finalist for Intuitive Surgical Best Paper Award)

48. Vincent Duindam, Jijie Xu, Ron Alterovitz, Shankar Sastry, and Ken Goldberg, “3D Motion Planning Algorithms for Steerable Needles Using Inverse Kinematics,” in *Algorithmic Foundation of Robotics VIII (WAFR 2008)*, G. S. Chirikjian et al. (Eds.), STAR vol. 57, Springer-Verlag, Dec. 2008, pp. 535–549.
49. Kyle B. Reed, Vinutha Kallem, Ron Alterovitz, Ken Goldberg, Allison M. Okamura, and Noah J. Cowan, “Integrated Planning and Image-Guided Control for Planar Needle Steering,” in *Proc. IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)*, Oct. 2008, pp. 819–824.
50. Jeremy Schiff, Anand Kulkarni, Danny Bazo, Vincent Duindam, Ron Alterovitz, Dezhen Song, and Ken Goldberg, “Actuator Networks for Navigating an Unmonitored Mobile Robot,” in *Proc. IEEE International Conference on Automation Science and Engineering (CASE)*, Aug. 2008, pp. 53–60.
51. Jijie Xu, Vincent Duindam, Ron Alterovitz, and Ken Goldberg, “Motion Planning For Steerable Needles in 3D Environments with Obstacles Using Rapidly-Exploring Random Trees and Backchaining,” in *Proc. IEEE International Conference on Automation Science and Engineering (CASE)*, Aug. 2008, pp. 41–46.
52. Vincent Duindam, Ron Alterovitz, Shankar Sastry, and Ken Goldberg, “Screw-Based Motion Planning for Bevel-Tip Flexible Needles in 3D Environments with Obstacles,” in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2008, pp. 2483–2488.
53. Ron Alterovitz, Thierry Siméon, and Ken Goldberg, “The Stochastic Motion Roadmap: A Sampling Framework for Planning with Markov Motion Uncertainty,” in *Robotics: Science and Systems III (Proc. RSS 2007)*, W. Burgard et al. (Eds.), MIT Press, 2008, pp. 233–241. **(Ranked in 2015 as a top 20 most cited paper from RSS in the last 10 years)**
54. Ron Alterovitz, Michael Branicky, and Ken Goldberg, “Constant-Curvature Motion Planning Under Uncertainty with Applications in Image-Guided Medical Needle Steering,” in *Algorithmic Foundation of Robotics VII (WAFR 2006)*, S. Akella et al. (Eds.), STAR vol. 47, Springer-Verlag, 2008, pp. 319–334.
55. Ron Alterovitz, Andrew Lim, Ken Goldberg, Gregory S. Chirikjian, and Allison M. Okamura, “Steering Flexible Needles Under Markov Motion Uncertainty,” in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Aug. 2005, pp. 120–125.
56. Ron Alterovitz, Ken Goldberg, and Allison M. Okamura, “Planning for Steerable Bevel-tip Needle Insertion Through 2D Soft Tissue with Obstacles,” in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, Apr. 2005, pp. 1652–1657.
57. Ron Alterovitz, Ken Goldberg, John Kurhanewicz, Jean Pouliot, and I-Chow Hsu, “Image Registration for Prostate MR Spectroscopy Using Biomechanical Modeling and Optimization of Force and Stiffness Parameters,” in *Proc. 26th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS)*, Sept. 2004, pp. 1722–1725.
58. Ron Alterovitz, Jean Pouliot, Richard Taschereau, I-Chow Hsu, and Ken Goldberg, “Sensorless Planning for Medical Needle Insertion Procedures,” in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2003, pp. 3337–3343. **(Best Paper Award Finalist)**

59. Ron Alterovitz, Jean Pouliot, Richard Taschereau, I-Chow Hsu, and Ken Goldberg, “Needle Insertion and Radioactive Seed Implantation in Human Tissues: Simulation and Sensitivity Analysis,” in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, Sept. 2003, pp. 1793–1799.
60. James Moller, Mathew Carlson, Ron Alterovitz, and Joseph Swartz, “Post-ejection Cooling Behavior of Injection Molded Parts,” in *Proc. 56th Annual Technical Conference (ANTEC '98)*, vol. 1, Society of Plastics Engineers, Brookfield, CT, 1998, pp. 525–529.

CONFERENCE ABSTRACTS

1. Raul Wirz, Luis Torres, Philip Swaney, Hunter Gilbert, Ron Alterovitz, Robert Webster, Kyle Weaver, and Paul Russell, “Teleoperation of Concentric Tube Robots for Skull Base Applications: Pituitary Surgery at a Distance?,” *North American Skull Base Society (NASBS) Annual Meeting*, Tampa, FL, Feb. 2015.
2. Andinet Enquobahrie, Vikas Shivaprabhu, Stephen Aylward, Julien Finet, Kevin Cleary, and Ron Alterovitz, “Patient-specific Port Placement for Laparoscopic Surgery Using Atlas-based Registration,” *SPIE Medical Imaging*, Lake Buena Vista, FL, Feb. 2013.
3. Guus Vrooijink, Momen Abayazid, Sachin Patil, Ron Alterovitz, and Sarthak Misra, “Three-dimensional Flexible Needle Steering Using Two-dimensional Ultrasound Images,” *4th Dutch Bio-Medical Engineering Conference*, Egmond aan Zee, The Netherlands, Jan. 2013.
4. Nuttapon Chentanez, Ron Alterovitz, Daniel Ritchie, Lita Cho, Kris K. Hauser, Ken Goldberg, Jonathan R. Shewchuk, and James F. O’Brien, “Simulation of Needle Insertion and Tissue Deformation for Modeling Prostate Brachytherapy,” *American Brachytherapy Society (ABS) Annual Meeting*, Atlanta, GA, April 2010.
5. Sophie Barbe, Isabelle Andre, Juan Cortes, Ron Alterovitz, Vincent Lafaquiere, David Guieysse, Pierre Monsan, Magali Remaud-Siméon, and Thierry Siméon, “A Robotic-based Path Planning Approach for Computing Large-Amplitude Motions of Flexible Molecules,” *Fifteenth Meeting on Graphics and Molecular Modeling (GGMM)*, Grenoble, France, May 2007.
6. Michael Wehner, Ron Alterovitz, and Ken Goldberg, “Geometric Nonlinearity: Is it Important for Real-time FEM Surgical Simulation?,” *Medicine Meets Virtual Reality 14 (MMVR14)*, Long Beach, CA, Jan. 2006.
7. Ron Alterovitz, Etienne Lessard, Jean Pouliot, I-Chow Hsu, James F. O’Brien, and Ken Goldberg, “High-dose-rate Brachytherapy Dose Optimization for Prostate Cancer Using Linear Programming,” *Institute for Operations Research and the Management Sciences (INFORMS) Annual Meeting*, San Francisco, CA, Nov. 2005.
8. Ron Alterovitz, Yongbok Kim, John Kurhanewicz, Jean Pouliot, I-Chow Hsu, and Ken Goldberg, “Prostate MR Spectroscopy Image Registration Using Biomechanical Modeling of Tissue Deformations due to Endorectal Probe Insertion,” *American Brachytherapy Society (ABS) 26th Annual Meeting*, San Francisco, CA, June 2005.
9. Ron Alterovitz, Ken Goldberg, John Kurhanewicz, Jean Pouliot, and I-Chow Hsu, “Registering MR with MRS Images for HDR Prostate Treatment using Finite Element Modeling,” *46th American Association of Physicists in Medicine (AAPM) Annual Meeting*, Pittsburgh, PA, July 2004.

10. Ron Alterovitz, Jean Pouliot, Richard Taschereau, I-Chow Hsu, and Ken Goldberg, “Modeling Seed Misplacement by Simulating Tissue Deformations,” *American Brachytherapy Society (ABS) 24th Annual Meeting*, New York, NY, May 2003.
11. Ron Alterovitz, Jean Pouliot, Richard Taschereau, I-Chow Hsu, and Ken Goldberg, “Simulating Needle Insertion and Radioactive Seed Implantation for Prostate Brachytherapy,” in *Medicine Meets Virtual Reality 11 (MMVR11)*, J.D. Westwood et al. (Eds.), IOS Press, Jan. 2003, pp. 19–25.

PATENTS

1. Ron Alterovitz, Richard H. Feins, Bryan I. Hartley, Alan D. Kuntz, Erik Lamers, Arthur W. Mahoney, Andria A. Remirez, Philip J. Swaney, and Robert J. Webster III, “Methods, systems, and computer readable media for transoral lung access,” United States Patent Application Serial No. 62/165,656, filed May 2015.
2. Ron Alterovitz, Luis G. Torres, Philip J. Swaney, Hunter B. Gilbert, Robert J. Webster III, and Richard J. Hendrick, “Methods, systems, and computer readable media for controlling a concentric tube probe,” United States Patent Application Serial No. 62/165,648, filed May 2015.
3. Robert J. Webster III, Allison M. Okamura, Noah J. Cowan, Gregory S. Chirikjian, Ken Goldberg, and Ron Alterovitz, “Distal bevel-tip needle control device and algorithm,” United States Patent 7,822,458, filed in 2005, awarded Oct. 2010.
(Licensed by multiple companies)

INVITED TALKS

1. *Blue Cross NC Tech Summit*, Raleigh, NC, Mar. 22, 2018.
2. *California Institute of Technology (Caltech)*, Department of Medical Engineering, Pasadena, CA, Feb. 22, 2018.
3. *City of Hope National Medical Center*, Duarte, CA, Feb. 22, 2018.
4. *University of California, San Diego (UCSD)*, Contextual Robotics Institute, La Jolla, CA, Oct. 19, 2017.
5. *Workshop on Medical Imaging Robotics*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Vancouver, Canada, Sep. 28, 2017.
6. *Workshop on Continuum Robots in Medicine - Design, Integration, and Applications*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Vancouver, Canada, Sep. 24, 2017.
7. *Workshop on Minimality and Trade-offs in Automated Robot Design*, Robotics: Science and Systems (RSS) Conference, Boston, MA, July 16, 2017.
8. *Workshop on POMDPs in Robotics: State of The Art, Challenges, and Opportunities*, Robotics: Science and Systems (RSS) Conference, Boston, MA, July 15, 2017.
9. *Robo-Healthcare Summit*, Boston, MA, June 28, 2017.

10. *Worcester Polytechnic Institute (WPI)*, Robotics Engineering Colloquium, Worcester, MA, June 26, 2017.
11. *Georgia Tech*, School of Interactive Computing, Atlanta, GA, Apr. 13, 2017.
12. *Yale University*, Department of Computer Science, New Haven, CT, Mar. 13, 2017.
13. *Vanderbilt University*, Department of Electrical Engineering and Computer Science, Nashville, TN, Feb. 23, 2017.
14. *University of Utah*, Scientific Computing and Imaging (SCI) Institute, Salt Lake City, UT, Jan. 12, 2017.
15. *Intuitive Surgical Inc.*, North Carolina Office, Raleigh, NC, Nov. 4, 2016.
16. *University of Chicago*, Department of Computer Science, Chicago, IL, Oct. 20, 2016.
17. *Wake Forest Institute of Regenerative Medicine (WFIRM)*, Winston-Salem, NC, Sep. 21, 2016.
18. *University of California, Berkeley*, Center for Information Technology Research in the Interest of Society (CITRIS), Berkeley, CA, Aug. 11, 2016.
19. *Stanford University*, Department of Mechanical Engineering, Stanford, CA, Aug. 9, 2016.
20. *Workshop: Towards Clinical Impact In Robotic Assisted Neuro And Skull-Base Surgery*, Hamlyn Symposium on Medical Robotics, London, England, June 28, 2016.
21. *Workshop on Planning for Human-Robot Interaction: Shared Autonomy and Collaborative Robotics*, Robotics: Science and Systems (RSS) Conference, Ann Arbor, MI, June 18, 2016.
22. *Cultural Event on Leading Innovation: Inventing the Future with Science*, Salem College (the oldest continuously operating women's educational institution in the United States), Salem, NC, Apr. 12, 2016.
23. *North Carolina Federal Advanced Technologies Quarterly Meeting*, Fayetteville, NC, Nov. 18, 2015.
24. *Schloss Dagstuhl – Leibniz Center for Informatics*, Seminar on Multimodal Manipulation Under Uncertainty, Dagstuhl, Germany, Oct. 5, 2015.
25. *Workshop on Navigation and Actuation of Flexible Instruments in Medical Applications*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Hamburg, Germany, Oct. 2, 2015.
26. *Technical University of Berlin*, Robotics and Biology Laboratory, Berlin, Germany, June 26, 2015.
27. *Qualcomm Inc.*, San Diego, CA (via teleconference), Aug. 26, 2015.
28. *North Carolina Federal Advanced Technologies Review*, Raleigh, NC, June 3, 2015.
29. *Optimal Robot Motion Planning Workshop*, IEEE International Conference on Robotics and Automation (ICRA), Seattle, WA, May 30, 2015.

30. *Robotics Science and Systems 2015 Symposium: Frontiers of Robotics*, Rutgers University, New Brunswick, NJ, Mar. 27, 2015.
31. *Allied Health Sciences Research Forum*, Chapel Hill, NC, Feb. 25, 2015.
32. *Association for Advancing Automation (A3) Business Forum*, Orlando, FL, Jan. 23, 2015.
33. *University of Arizona*, Department of Electrical and Computer Engineering, Tucson, AZ, Nov. 6, 2014.
34. *École Polytechnique Fédérale de Lausanne (EPFL)*, Swiss National Centre of Competence in Research (NCCR) Robotics, Lausanne, Switzerland, Oct. 13, 2014.
35. *ABB Corporation*, Raleigh, NC, May 13, 2014.
36. *Hong Kong Polytechnic University*, Department of Industrial and Systems Engineering, Hong Kong, May 29, 2014.
37. *Texas A&M University*, Department of Computer Science and Engineering, College Station, TX, Feb. 26, 2014.
38. *University of Utah*, School of Computing, Salt Lake City, UT, Dec. 5, 2013.
39. *Massachusetts Institute of Technology*, Computer Science and Artificial Intelligence Laboratory (CSAIL), Cambridge, MA, Nov. 22, 2013.
40. *Johns Hopkins University*, Center for Computer Integrated Surgical Systems and Technology (CISST), Baltimore, MD, Nov. 20, 2013.
41. *Carnegie Mellon University*, Robotics Institute, Pittsburgh, PA, Nov. 15, 2013.
42. *Rice University*, Department of Computer Science, Houston, TX, Nov. 7, 2013.
43. *Sigma Xi: The Scientific Research Society*, Research Triangle Park, NC, Jan. 23, 2013.
44. *Workshop on Stochastic Motion Planning and Information-Based Control*, Robotics: Science and Systems (RSS) Conference, Sydney, Australia, July 11, 2012.
45. *Workshop on Pathways to Clinical Needle Steering*, IEEE International Conference on Robotics and Automation (ICRA), St. Paul, MN, May 18, 2012.
46. *Vanderbilt University*, Vanderbilt Initiative in Surgery and Engineering (VISE), Nashville, TN, Mar. 29, 2012.
47. *University of South Carolina*, Computer Science and Engineering Department, Columbia, SC, Nov. 18, 2011.
48. *SACNAS (Society for the Advancement of Chicanos and Native Americans in Science) National Conference*, San Jose, CA, Oct. 28, 2011.
49. *Case Western Reserve University*, Department of Electrical Engineering and Computer Science, Cleveland, OH, Aug. 11, 2009.
50. *Carnegie Mellon University*, Robotics Institute, Pittsburgh, PA, June 17, 2008.
51. *Arizona State University*, Department of Biomedical Informatics, Phoenix, AZ, May 22, 2008.

52. *Vanderbilt University*, Department of Mechanical Engineering, Nashville, TN, Apr. 21, 2008.
53. *University of North Carolina at Chapel Hill*, Department of Computer Science, Chapel Hill, NC, Mar. 17, 2008.
54. *Johns Hopkins University*, Center for Computer Integrated Surgical Systems and Technology (CISST), Baltimore, MD, Mar. 5, 2008.
55. *University of California, Davis*, Center for Information Technology Research in the Interest of Society, Sacramento, CA, Jan. 18, 2008.
56. *Workshop on Algorithmic Motion Planning*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), San Diego, CA, Oct. 29, 2007.
57. *University of California, Berkeley*, Department of Electrical Engineering and Computer Sciences, Berkeley, CA, Oct. 11, 2007.
58. *LAAS-CNRS* (National Center for Scientific Research), Toulouse, France, Oct. 26, 2006.
59. *University of California, Irvine*, Department of Computer Science, Irvine, CA, Apr. 25, 2006.
60. *University of California, Berkeley*, Department of Industrial Engineering and Operations Research, Berkeley, CA, Oct. 28, 2005.
61. *Case Western Reserve University*, Department of Electrical Engineering and Computer Science, Cleveland, OH, Aug. 18, 2005.
62. *Workshop on Medical Robotics and Welfare*, IEEE International Conference on Robotics and Automation (ICRA), Barcelona, Spain, Apr. 18, 2005.
63. *George Washington University*, Colloquium of the Institute for Biomedical Engineering, Washington, DC, Mar. 25, 2005.
64. *Johns Hopkins University*, Center for Computer Integrated Surgical Systems and Technology (CISST), Baltimore, MD, Mar. 23, 2005.
65. *Workshop on Reality-Based Modeling of Tissues for Simulation and Robot-Assisted Surgery*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Las Vegas, NV, Oct. 31, 2003.
66. *Workshop on Recent Advances in Medical Robotics*, IEEE International Conference on Robotics and Automation (ICRA), Taipei, Taiwan, Sept. 15, 2003.

TEACHING ACTIVITIES

COURSES TAUGHT AND DEVELOPED

Data Structures (COMP 410)

Fall 2014 (75 students), Fall 2015 (92 students).

This course, required for undergraduate Computer Science majors and minors, covers widely-used data structures from two perspectives: how to use them and how to implement them in an efficient manner. The course introduces terminology for expressing the efficiency of implementations, and techniques for evaluating algorithms to determine their efficiency. Students implement several data structures using the Java programming language.

Introduction to Robotics (COMP 581, formerly offered as COMP 590-099) (**New course**)

Spring 2011 (24 students), Spring 2012 (29 students), Spring 2013 (24 students), Fall 2017 (46 students).

I developed this new course to provide undergraduate juniors and seniors with a hands-on introduction to robotics emphasizing the computational and algorithmic aspects. Topics include robot kinematics, actuation, sensing, control, motion planning, and applications including personal assistance, autonomous vehicles, medical surgery, and manufacturing. In addition to participating in lectures and discussions, students design and program (using Java) LEGO-based mobile robots, culminating in an end-of-semester robot contest.

Robotics (COMP 781, formerly offered as COMP 790-099)

Fall 2009 (12 students), Fall 2010 (16 students), Fall 2012 (27 students), Spring 2014 (26 students), Spring 2015 (18 students), Spring 2016 (20 students), Spring 2018 (28 students).

This course introduces graduate students to the programming and control of robotic systems. Topics include kinematics, actuation, sensing, manipulation, control, and motion planning. We discuss applications including industrial, transportation, and medical robotics. Students participate in interactive lectures and discussions, complete mathematical and programming assignments, and present an integrative course project.

Motion Planning in Physical and Virtual Worlds (COMP 782, formerly offered as COMP 790-099)

Spring 2010 (12 students), Fall 2011 (10 students), Fall 2016 (12 students).

This course introduces graduate students to the current state-of-the-art and challenges in computing motions for robots, agents, and characters in physical and virtual worlds. Topics include path planning for autonomous agents/robots, computing motion policies in uncertain environments, the theoretical underpinnings of motion planning, and applications to surgical planning, autonomous vehicles, graphics, games, and other areas. The course includes lectures, discussions on current research challenges, mathematical problem sets, programming assignments, and a course project.

Recent Advances in Medical Robotics and Simulation (COMP 790-099)

Spring 2009 (6 students).

This special topics graduate seminar covers recent research and open problems in medical robotics and physically-based simulation of medical procedures. Lectures cover medical robotics systems, image-guided motion planning for medical devices, tissue modeling, and surgery simulation. In addition, students present recent papers and undertake projects in medical robotics and simulation.

Technical Communication in Computer Science (COMP 915)

Spring 2015 (co-taught with Fred Brooks, 25 students), Spring 2016 (co-taught with David Stotts, 13 students).

This graduate student seminar covers teaching, short oral presentations, and writing in computer science. The goals are to lead students in thinking about teaching as a design challenge; have students practice techniques of planning, preparation, assignment design, and presentation; and give students exposure to the literature on teaching techniques for academic or professional life.

GRANTS

CURRENT GRANTS

NIH R01 EB024864, 9/15/2017–6/30/2021

“Bronchoscopic Steerable Needles for Transparenchymal Access to Lung Nodules”

Role: *PI*

Percent effort: 1 month/year

Awarded (to date): \$527,452 (total costs); \$415,702 (total direct costs)

Award (expected total): \$2,025,189 (total costs); \$1,610,074 (total direct costs)

NSF CCF-1533844, 9/1/2015–8/31/2019

“XPS: FULL: DSD: Parallel Motion Planning for Cloud-connected Robots”

Role: *PI*

Percent effort: 1 month/year

Awarded: \$670,536 (total costs); \$464,687 (total direct costs)

UNC-Chapel Hill Associate Professor Support Program, 9/1/2015–8/31/2020

“Enabling Robots to Learn a Broader Class of Tasks from Humans”

Role: *PI*

Percent effort: 0.5 months (expected)

Awarded: \$6,000 (total direct costs)

NSF IIS-1149965 Supplemental Support, 4/3/2015–2/28/2019

“US/EU Collaboration on Robot Motion Planning for Learned Tasks Requiring Compliant Manipulation”

Role: *PI*

Percent effort: 1 month/year

Awarded: \$49,984 (total costs); \$33,773 (total direct costs)

NSF IIS-1149965, 3/1/2012–2/28/2019

“CAREER: Toward Automating Surgical Tasks”

Role: *PI*

Percent effort: 1 month/year

Awarded: \$449,558 (total costs); \$315,379 (total direct costs)

COMPLETED GRANTS

NIH R01 EB017467, 7/1/2013–5/31/2018

“Robotic Natural Orifice Skull Base Surgery”

Role: *Co-Investigator on project, PI on UNC-Chapel Hill subcontract*

Percent effort: 1 month/year

Awarded: \$1,747,039. UNC-Chapel Hill subcontract is \$316,079 (total costs); \$220,032 (total direct costs)

NIH R01 CA158925, 4/1/2013–3/31/2018

“Integration of Endoscopic and CT Data for Radiation Therapy Treatment Planning”

Role: *Co-Investigator*, PI is Julian G. Rosenman (UNC-Chapel Hill Radiation Oncology)

Percent effort: 1 month/year

Awarded: \$1,277,055 (total costs); \$863,620 (total direct costs)

NSF CNS-1305286, 9/1/2013–8/31/2017

“II-NEW: A Robot Testbed for Real-time Motion Strategies and Autonomous Personal Assistants”

Role: *Co-PI*, PI is Dinesh Manocha (UNC-Chapel Hill Computer Science)
Percent effort: 0 (award used for equipment and supplies)
Awarded: \$339,495 (total costs); \$335,855 (total direct costs)

NIH R21 EB017952, 9/30/2013–8/31/2016

“Multi-lumen Steerable Needles for Transoral Access to Lung Nodules”

Role: *PI*

Percent effort: 1 month/year

Awarded: \$409,127 (total costs); \$320,409 (total direct costs)

NSF IIS-1349355, 8/1/2013–7/31/2016

“Workshop: Robot Planning in the Real World: Research Challenges and Opportunities”

Role: *PI*

Percent effort: 0 (award used to support workshop participants)

Awarded: \$48,058 (total costs); \$45,361 (total direct costs)

NSF IIS-1117127, 9/1/2011–8/31/2015

“SHB: Small: Computing Robot Motions for Home Healthcare Assistance”

Role: *PI*

Percent effort: 1 month/year

Awarded: \$350,000 (total costs); \$246,383 (total direct costs)

NIH R21 EB011628, 6/1/2010–5/31/2013

“Reaching Inaccessible Anatomy Percutaneously via Multi-lumen Steerable Needles”

Role: *PI*

Percent effort: 1 month/year

Awarded: \$414,960. UNC-Chapel Hill subcontract is \$191,085 (total costs); \$131,527 (total direct costs)

NSF IIS-0905344, 8/1/2009–7/31/2013

“RI: Medium: Robust Intelligent Manipulation and Apprenticeship Learning for Robotic Surgical Assistants”

Role: *Co-PI on project, PI on UNC-Chapel Hill subcontract*

Percent effort: 0.5 month/year

Awarded: \$1,359,881. UNC-Chapel Hill subcontract is \$227,250 (total costs); \$162,394 (total direct costs)

NSF/CRA/CCC Computing Innovation Fellows Project Award, 8/20/2009–8/19/2011

Role: *PI/Mentor of Postdoctoral Fellow Edgar J. Lobaton*

Percent effort: 0 (award was used to support a postdoctoral fellow and for supplies)

Awarded: \$267,500 (total costs); \$214,000 (total direct costs)

NIH F32 CA124138, 8/29/2007–12/31/2008

“Deformable Registration for Image-guided Radiotherapy”

Role: *PI*

Percent effort: 12 months/year

Awarded: \$62,088 (total costs); \$62,088 (total direct costs)

PROFESSIONAL SERVICE

STRATEGIC PLANNING SYMPOSIA

2015 *Invited Speaker and Panelist*, North Carolina Federal Advanced Technologies Review, an event organized by the North Carolina Military Business Center

(NCMBC) to highlight ideas and products under development in North Carolina relevant to the Department of Defense.

- 2013 *Co-Organizer*, NSF Workshop on Robot Planning in the Real World: Research Challenges and Opportunities. The workshop brought together 37 select individuals from academia, industry, and government agencies to discuss a roadmap and identify challenge problems for the field of robot planning with the goal of making robots less reliant on human supervision and more widely deployable in the real world. Co-organized with Sven Koenig (University of Southern California) and Maxim Likhachev (Carnegie Mellon University).
- 2012 *Invited Participant*, CCC/NSF/NIH Computing and Healthcare Symposium aimed at fostering interest in this interdisciplinary field and generating a report describing basic research questions at the intersection of computing and health.
- 2008 *Invited Participant*, NSF/CCC/CRA Roadmapping for Robotics Workshop: A Research Roadmap for Medical and Healthcare Robotics, Arlington, VA. The resulting report helped build support for the National Robotics Initiative, a \$70 million investment in robotics announced by the federal government in 2011.

CONFERENCE WORKSHOPS AND SPECIAL SESSIONS

- 2017 *Co-Organizer*, Workshop on C⁴ Surgical Robots: Compliant, Continuum, Cognitive, and Collaborative, at the IEEE International Conference on Robotics and Automation (ICRA), Singapore. Attended by over 60 international researchers.
- 2016 *Co-Organizer*, Open Problems Session at the Workshop on the Algorithmic Foundations of Robotics (WAFR), San Francisco, CA.
- 2012 *Co-Organizer*, Workshop on Algorithmic Frontiers in Medical Robotics, at the Robotics: Science and Systems (RSS) 2012 Conference, Sydney, Australia
- 2011 *Co-Organizer*, “50 Years of Robotics” Special Symposium on “Robot Motion Planning: Achievements and Emerging Approaches” at the IEEE/RSJ International Conference on Intelligent Robots and Systems, San Francisco, CA. The keynote speaker was motion planning pioneer Prof. Tomas Lozano-Perez from MIT.
- 2010 *Co-Organizer*, Workshop on Medical Cyber-Physical Systems, at the IEEE International Conference on Robotics and Automation (ICRA), Anchorage, AK. The workshop featured speakers from academia as well as industry (Intuitive Surgical, Inc.). Attended by over 50 international researchers.
- 2008 *Co-Organizer*, Workshop on Medical Needle Steering: Recent Results and Future Opportunities, at the 11th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), New York, NY.

EDITORIAL BOARDS, PROGRAM COMMITTEES, AND PROPOSAL REVIEW PANELS

- 2014–2018 *Associate Editor*, IEEE Transactions on Automation Science and Engineering (T-ASE).
- 2018 *Program Committee Member*, International Symposium on Experimental Robotics (ISER).
- 2017 *Reviewer*, National Institutes of Health, Bethesda, MD.
- 2011, 2013, 2014, 2015 *Panelist*, National Science Foundation, Arlington, VA.

- 2015 *Area Chair*, Robotics: Science and Systems Conference (RSS).
- 2008, 2011, 2014, 2017 *Program Committee Member*, Robotics: Science and Systems Conference (RSS).
- 2014 *Associate Editor*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).
- 2011–’13, ’18 *Associate Editor*, IEEE International Conference on Robotics and Automation (ICRA).
- 2012, ’14, ’16 *Program Committee Member*, International Workshop on the Algorithmic Foundations of Robotics (WAFR).
- 2011 *Senior Program Committee (SPC) Member*, 2012 IEEE International Conference on Robotics and Automation (ICRA), SPC Meeting, Philadelphia, PA.

REVIEWS FOR JOURNALS AND CONFERENCES

International Journal of Robotics Research (IJRR)
 IEEE Transactions on Robotics (T-RO)
 IEEE Robotics and Automation Letters (RA-L)
 IEEE Transactions on Information Technology in Biomedicine
 IEEE Transactions on Biomedical Engineering
 IEEE/ASME Transactions on Mechatronics
 Mathematics of Operations Research
 Medical Image Analysis Journal
 Medical Physics (*Reviewer and Associate Editor*)
 Computer Aided Surgery
 International Journal of Computer Assisted Radiology and Surgery
 Robotics: Science and Systems Conference (RSS)
 Workshop on the Algorithmic Foundations of Robotics (WAFR)
 Second International Symposium on Medical Simulation
 IEEE International Conference on Robotics and Automation (ICRA)
 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
 IEEE Visualization
 Medical Image Computing and Computer Assisted Interventions Conference (MICCAI)

PROFESSIONAL SOCIETIES

- 2009–2015 *Co-Chair*, Technical Committee on Algorithms for Planning and Control of Robot Motion, IEEE Robotics and Automation Society. In a 2012 survey of IEEE Robotics and Automation Society members, this technical committee area was ranked #1 out of 28 in the category of “importance” to members’ work and/or interests.
- 2008–2010 *Co-Chair*, Technical Committee on Surgical Robotics, IEEE Robotics and Automation Society.
- 2003–present *Member*, IEEE Robotics and Automation Society.

UNIVERSITY COMMITTEES

- 2017–present *Chair*, Graduate Admissions Committee, Department of Computer Science, University of North Carolina at Chapel Hill.
- 2017–present *Member*, Science Complex Phase III Applied Physical Sciences User Group Committee, College of Arts & Sciences, University of North Carolina at Chapel Hill.
- 2016, 2018 *Member*, Faculty Search Committee, Department of Computer Science, University of North Carolina at Chapel Hill.
- 2009, '12–'16, *Member*, Graduate Admissions Committee, Department of Computer Science, University of North Carolina at Chapel Hill.
Served temporarily as Acting Chair in January 2016.
- 2014–2016 *Member*, Graduate Curriculum and Planning Committee, Department of Computer Science, University of North Carolina at Chapel Hill.
- 2012–2013 *Member*, Faculty Search Committee, UNC-NCSU Joint Department of Biomedical Engineering.
- 2009–2011 *Member*, Facilities and Web Committee, Department of Computer Science, University of North Carolina at Chapel Hill.
- 2009 *Member*, Faculty Search Committee, Curriculum in Applied Sciences and Engineering (CASE), University of North Carolina at Chapel Hill.

PRESS AND MEDIA

- 2017 *ABC 11 TV Eyewitness News*, “Tech takeover: Will a robot put you out of a job?,” by Jon Camp, May 25, 2017. The ABC 11 TV station serves North Carolina’s Research Triangle (Raleigh-Durham-Chapel Hill) and Fayetteville. The news report, which featured robots in our lab, discussed the capabilities of emerging robots and the potential impact of robotics on careers of the future. Available at <http://abc11.com/technology/tech-takeover-will-a-robot-put-you-out-of-a-job/2032292/>.
- 2016 *The Daily Tar Heel*, “Professor is the brains behind robots that advance in-home medical assistance,” by Dominic Andrews, Aug. 28, 2016. The Daily Tar Heel is an independent student newspaper with an average daily print circulation of around 10,000. Available at <http://www.dailytarheel.com/article/2016/08/professor-is-the-brains-behind-robots-that-advance-in-home-medical-assistance>.
- 2015 *Ivanhoe Broadcast News*, “Snakelike robotic device fighting cancer.” Aired on media with a circulation (unique monthly viewers) of over 1 million, including local news TV shows in Texas, Pennsylvania, Michigan, and Alabama in April 2015.
- 2015 *Forbes*, “Robots and Real-World Variability: When Change Happens, Adapt,” by Jim Lawton, Apr. 4, 2015. Video from research group featured in the article available at <http://www.forbes.com/sites/jimlawton/2015/04/01/robots-and-real-world-variability-when-change-happens-adapt/2/>
- 2015 *ExitEvent*, “Meet the UNC Researchers Behind Sugar-Scooping, Surgery-Performing, Self-Driving Robots,” by Aaron Scarboro, Feb. 18, 2015. Available at <http://www.exitevent.com/article/meet-the-unc-researchers-behind-sugar-scooping-robots-150218>
- 2014 *UNC-Chapel Hill’s main web page*, “Algorithms, robotics: healing potential,” by Zach Read and Scott Jared, Feb. 24, 2014. Spotlight appeared

- on <http://unc.edu>. Article available at <http://www.unc.edu/spotlight/algorithms-robotics-healing-potential/>
- 2014 *UNC School of Medicine Vital Signs*, “Human Interactions, Robotic Solutions: The university’s culture of collaboration is leading to new possibilities for diagnosing and attacking cancers – by using robots,” by Zach Read, Feb. 6, 2014. Spotlight appeared on <http://med.unc.edu>. Article available at <http://news.unchealthcare.org/som-vital-signs/2014/feb-6/human-interactions-robotic-solutions>
- 2014 *American Scientist Magazine*, “Pizza Lunch Podcasts: Robots in Clinical and Home Environments,” by Katie-Leigh Lubinsky, Feb. 3, 2014. Available at <http://www.americanscientist.org/science/pub/robots-in-clinical-and-home-environments>
- 2013 *Radio In Vivo: Your Link to the Triangle Science Community*, Radio Show Guest, Jun. 19, 2013. Podcast available at <http://radioinvivo.org/2013/06/19/computational-robotics/>
- 2012 *Endeavors Magazine*, “They, Robots: The future where robots inhabit the earth is already here,” by Susan Hardy, Oct. 4, 2012. Available at http://endeavors.unc.edu/they_robots
- 2012 *Carolina Arts & Sciences Magazine*, “They, Robots: The future is already here,” by Susan Hardy, Sep. 18, 2012. Available at <http://college.unc.edu/2012/09/18/robots/>
- 2010 *US News & World Report*, “Teaching Medical Robots: Research aims to make robots smarter,” by Marlene Cimon, Nov. 22, 2010. Available at <http://www.usnews.com/science/articles/2010/11/22/teaching-medical-robots.html>

COMMUNITY OUTREACH

- 2016 *Invited Speaker and Panelist*, Cultural Event on Leading Innovation: Inventing the Future with Science, Salem College, Salem, NC. Presented the state-of-the-art in medical robots to community members and students at the oldest continuously operating women’s educational institution in the United States.
- 2014 *Invited Speaker and Panelist*, Program in the Humanities and Human Values, UNC-Chapel Hill College of Arts and Sciences. Discussed robotics at the “Minds and Machines” session of the *Adventures in Ideas* weekend seminar series that features in-depth explorations of topics for lifelong learners in the general public.
- 2013 *Safety Advisor/Judge*, FIRST Robotics NC Regional Tournament for high school students in Raleigh, NC.
- 2012 *Panelist*, Deep Dish Theater Company in Chapel Hill, NC. Invited by Artistic Director Paul Frellick to answer audience questions about robotics at a post-performance panel discussion of Alan Ayckbourn’s *Henceforward...*, a play involving a robot in a futuristic society.
- 2012 *Faculty Mentor*, Science and Math Achievement and Resourcefulness Track Program (SMART), sponsored by NSF to increase the number of underrepresented minority undergraduate students who earn degrees in science, technology, engineering, and mathematics (STEM) disciplines.
- 2011 *Invited Speaker and Poster Judge*, SACNAS (Society for the Advancement of Chicanos and Native Americans in Science) National Conference, San Jose, CA

- 2011–present YouTube Channel UNCRobotics: <http://www.youtube.com/user/UNCRobotics>
Our videos showing our research on medical and assistive robots have been viewed over 200,000 times.
- 2009–present Worked with my research group to create interactive robotics demonstrations for hundreds of high school and middle school students and community members attending department-organized events and the annual UNC Science Expo.