Shishir N. Y. Kolathaya Ph.D.

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Education

Georgia Institute of Technology — ATLANTA, GEORGIA, USA
Doctor of Philosophy in Mechanical Engineering *2013 – 2016*
Thesis Title: Input to State Stabilizing Control Lyapunov Functions for Hybrid Systems
Committee: Aaron D. Ames (advisor), Magnus Egerstedt, Patricio Vela, Jonathan Rogers, Jun Ueda

Texas A&M University — COLLEGE STATION, TEXAS, USA
Master of Science in Electrical and Computer Engineering *2010 – 2012*
Thesis Title: Bipedal Robotic Walking on Flat-ground, Up-slope and Rough Terrain with Human-Inspired Hybrid Zero Dynamics

National Institute of Technology Karnataka — SURATHKAL, KARNATAKA, INDIA
Bachelor of Technology in Electrical and Electronics Engineering *2004 – 2008*

Experience

Indian Institute of Science — BENGALURU, KARNATAKA, INDIA
INSPIRE Faculty Fellow *Jan '18 – present*
Working in the Robert Bosch Center for Cyber Physical Systems (RBCCPS) in IISc. I am currently working on real-time safety critical control for various robotic platforms like quadrotors, arms and legged robots. I am also exploring the confluence of learning and control, and also deep reinforcement learning (D-RL) based methods for legged robots.

California Institute of Technology — PASADENA, CALIFORNIA, USA
Postdoctoral Scholar *Jan '17 – Dec '17*
Worked with MisoRobotics on the 6-DOF arm project. The goal is to realize direct collocation based trajectory optimization with obstacles. A novel application of this method is with a burger flipping robot. Various tasks like transport, pickup and flipping of burgers can be planned and executed in real-time.

Tejas Networks Ltd. — BENGALURU, KARNATAKA, INDIA
R&D Engineer *Jun '08 – Jun '10*
Designed and fabricated two stand alone switching power supplies. Each power supply used a standard buck converter topology with hot swappable, current-voltage monitoring features.

Journal Publications

[1] S. Kolathaya and A. D. Ames. "Input-to-State Safety With Control Barrier Functions". In: *IEEE Control Systems Letters* 3.1 (Jan. 2019), pp. 108–113. ISSN: 2475-1456. DOI: 10.1109/LCSYS.2018.2853698.

[2] S. Kolathaya et al. "Direct Collocation for Dynamic Behaviors With Nonprehensile Contacts: Application to Flipping Burgers". In: *IEEE Robotics and Automation Letters* 3.4 (Oct. 2018), pp. 3677–3684. ISSN: 2377-3766. DOI: 10.1109/LRA.2018.2854910.

[3] A. D. Ames et al. "First steps toward formal controller synthesis for bipedal robots with experimental implementation". In: *Nonlinear Analysis: Hybrid Systems* 25 (2017), pp. 155 –173. ISSN: 1751-570X. DOI: https://doi.org/10.1016/j.nahs.2017.01.002. URL: http://www.sciencedirect.com/science/article/pii/S1751570X1730002X.

[4] S. Kolathaya and A. D. Ames. "Parameter to state stability of control Lyapunov functions for hybrid system models of robots". In: *Nonlinear Analysis: Hybrid Systems* (2016). ISSN: 1751-570X. DOI: http://dx.doi.org/10.1016/j.nahs.2016.09.003.

Conference Publications

[1] S. Kolathaya et al. "Direct Collocation for Dynamic Behaviors with Nonprehensile Contacts: Application to Flipping Burgers". In: *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems*. Oct. 2018. DOI: 10.1109/LRA.2018.2854910.

[2] S. Kolathaya and A. D. Ames. "Input-to-State Safety With Control Barrier Functions". In: *2018 IEEE 57th Conference on Decision and Control (CDC)*. Dec. 2018. DOI: 10.1109/LCSYS.2018.2853698.

[3] S. Kolathaya et al. "Input to State Stabilizing Control Lyapunov Functions for Robust Bipedal Robotic Locomotion". In: *2018 Annual American Control Conference (ACC)*. June 2018, pp. 2224–2230. DOI: 10.23919/ACC.2018.8430946.

[4] W.-L. Ma et al. "Bipedal Robotic Running with DURUS-2D: Bridging the Gap Between Theory and Experiment". In: *Proceedings of the 20th International Conference on Hybrid Systems: Computation and Control*. HSCC '17. Pittsburgh, Pennsylvania, USA: ACM, 2017, pp. 265–274. ISBN: 978-1-4503-4590-3. DOI: 10.1145/3049797.3049823. URL: http://doi.acm.org/10.1145/3049797.3049823.

[5] A. Hereid, S. Kolathaya, and A. D. Ames. "Online optimal gait generation for bipedal walking robots using legendre pseudospectral optimization". In: *2016 IEEE 55th Conference on Decision and Control (CDC)*. Dec. 2016, pp. 6173–6179. DOI: 10.1109/CDC.2016.7799218.

[6] S. Kolathaya, A. Hereid, and A. D. Ames. "Time dependent control Lyapunov functions and hybrid zero dynamics for stable robotic locomotion". In: *2016 American Control Conference (ACC)*. July 2016, pp. 3916–3921. DOI: 10.1109/ACC.2016.7525524.

[7] S. Kolathaya and A. D. Ames. "Parameter Sensitivity and Boundedness of Robotic Hybrid Periodic Orbits." In: vol. 48. 27. 2015, pp. 377 –382. DOI: http://dx.doi.org/10.1016/j.ifacol.2015.11.203.

[8] A. D. Ames et al. "First Steps Toward Formal Controller Synthesis for Bipedal Robots". In: *Proceedings of the 18th International Conference on Hybrid Systems: Computation and Control*. HSCC '15. Seattle, Washington, 2015, pp. 209–218. ISBN: 978-1-4503-3433-4. DOI: 10.1145/2728606.2728611.

[9] S. Kolathaya and A. D. Ames. "Exponential convergence of a unified CLF controller for robotic systems under parameter uncertainty". In: *2014 American Control Conference*. June 2014, pp. 3710–3715. DOI: 10.1109/ACC.2014.6859407. URL: http://ieeexplore.ieee.org/abstract/document/6859407/.

[10] W. L. Ma et al. "Human-inspired walking via unified PD and impedance control". In: *2014 IEEE International Conference on Robotics and Automation (ICRA)*. May 2014, pp. 5088–5094. DOI: 10.1109/ICRA.2014.6907605. URL: http://ieeexplore.ieee.org/document/6907605/.

[11] A. Hereid et al. "Dynamic Multi-domain Bipedal Walking with Atrias Through SLIP Based Human-inspired Control". In: *Proceedings of the 17th International Conference on Hybrid Systems: Computation and Control*. HSCC '14. Berlin, Germany, 2014, pp. 263–272. ISBN: 978-1-4503-2732-9. DOI: 10.1145/2562059.2562143.

[12] H. Zhao, S. Kolathaya, and A. D. Ames. "Quadratic programming and impedance control for transfemoral prosthesis". In: *2014 IEEE International Conference on Robotics and Automation (ICRA)*. May 2014, pp. 1341–1347. DOI: 10.1109/ICRA.2014.6907026.

[13] S. Kolathaya and A. D. Ames. "Achieving Bipedal Locomotion on Rough Terrain through Human-Inspired Control". In: *10th IEEE International Symposium on Safety Security and Rescue Robotics*. College Station, Texas, USA, Oct. 2012.

[14] S. N. Y. Kolathaya, M. Pasupuleti, and A. D. Ames. "Human-inspired underactuated bipedal robotic walking with AMBER on flat-ground, up-slope and uneven terrain". In: *2012 IEEE/RSJ International Conference on Intelligent Robots and Systems*. Oct. 2012, pp. 2478–2483. DOI: 10.1109/IROS.2012.6386182.

[15] Z. Huihua, S. N. Y. Kolathaya, and A. D. Ames. "Bipedal robotic running with partial hybrid zero dynamics and human-inspired optimization". In: *2012 IEEE/RSJ International Conference on Intelligent Robots and Systems*. Oct. 2012, pp. 1821–1827. DOI: 10.1109/IROS.2012.6386241.

[16] S. N. Y. Kolathaya, B. Kothapalli, and A. D. Ames. "Zeno behavior in electromechanical hybrid systems: From theory to experimental validation". In: *2012 American Control Conference (ACC)*. June 2012, pp. 2437–2442. DOI: 10.1109/ACC.2012.6315696.

Peer Reviewed Book Chapters

[1] S. N. Y. Kolathaya, M. Pasupuleti, and A. D. Ames. "From Formal Methods to Algorithmic Implementation of Human Inspired Control on Bipedal Robots". In: *Algorithmic Foundations of Robotics X: Proceedings of the Tenth Workshop on the Algorithmic Foundations of Robotics*. Ed. by E. Frazzoli et al. Berlin, Heidelberg: Springer Berlin Heidelberg, 2013, pp. 511–526. ISBN: 978-3-642-36279-8. DOI: 10.1007/978-3-642-36279-8_31.

[2] S. Kolathaya, W. L. Ma, and A. D. Ames. "Composing Dynamical Systems to Realize Dynamic Robotic Dancing". In: *Algorithmic Foundations of Robotics XI: Selected Contributions of the Eleventh International Workshop on the Algorithmic Foundations of Robotics*. Ed. by H. L. Akin et al. Cham: Springer International Publishing, 2015, pp. 425–442. ISBN: 978-3-319-16595-0. DOI: 10.1007/978-3-319-16595-0_25.

[3] J. P. Reher et al. "Algorithmic Foundations of Realizing Multi-Contact Locomotion on the Humanoid Robot DURUS". In: *The International Workshop on the Algorithmic Foundations of Robotics (WAFR) XII*. San Francisco, Dec. 2016. URL: http://wafr2016.berkeley.edu/.

Miscellaneous

[1] S. N. Y. Kolathaya. *Phase Uncertainty to State Stability of Continuous Periodic Orbits, arXiv preprint arXiv:1707.02258.* 2017.

[2] S. Kolathaya et al. *System Identification and Control of Valkyrie through SVA–Based Regressor Computation, arXiv preprint arXiv:1608.02683.* 2016.

[3] S. Kolathaya et al. *Human-Inspired Walking in AMBER 1.0 and AMBER 2.0, Dynamic Walking.* 2013.

Teaching Experience

Indian Institute of Science   BENGALURU, KARNATAKA, INDIA
   Robot Dynamics and Control–Graduate Level–CPS312   *Fall 2018*
     Was the main instructor for this course.

California Institute of Technology   PASADENA, CALIFORNIA, USA
   Dynamics and Control of Walking Robots–Graduate Level–CDS270-2   *Spring 2017*
     Taught two lectures, set homeworks, mentored projects, held office hours and also graded exams.

Georgia Institute of Technology   ATLANTA, GEORGIA, USA
   Nonlinear Systems–Graduate Level–ECE6552   *Spring 2016*
     Taught four lectures, set homeworks, mentored projects, held weekly office hours and also graded exams.

Achievements

- INSPIRE Faculty Fellowship - 2018, awarded by the Depart Department of Science and Technology INDIA.

- Best paper award (second author) for a seminal work on *Dynamic multi-domain bipedal walking with ATRIAS through slip based human-inspired control*, In the *Proceedings of the 17th international conference on Hybrid systems: Computation and Control*, 2014.

- Student travel award for the Workshop on Algorithmic Foundations in Robotics XI, 2014, Istanbul, Turkey.

List of Seminars and Presentations

- *Zeno behavior in electromechanical hybrid systems: From theory to experimental validation*, American Control Conference 2012, Montreal, Quebec, Canada.

- *From Formal Methods to Algorithmic Implementation of Human Inspired Control on Bipedal Robots*, Workshop on Algorithmic Foundations of Robotics X, Cambridge, Massachusetts, USA.

- *Human-inspired underactuated bipedal robotic walking with AMBER on flat-ground, up-slope and uneven terrain*, International Conference on Intelligent Robots and Systems 2012, Vilamoura, Algarve, Portugal.

- *Bipedal robotic running with partial hybrid zero dynamics and human-inspired optimization*, International Conference on Intelligent Robots and Systems 2012, Vilamoura, Algarve, Portugal.

- *Achieving Bipedal Locomotion on Rough Terrain through Human-Inspired Control*, International Symposium on Safety Security and Rescue Robotics 2012, College Station, Texas, USA.

- *Introduction to Human-Inspired Bipedal Walking*, Invited seminar 2012, National Institute of Technology Karnataka, Surathkal, Karnataka, India.

- *Human-Inspired Walking in AMBER 1.0 and AMBER 2.0*, Dynamic Walking 2013, Pittsburgh, USA.

- *Achieving Human-Inspired Bipedal Robotic Walking*, Invited seminar 2013, National Institute of Technology Karnataka, Surathkal, Karnataka, India.

- *Dynamic Multi-domain Bipedal Walking with ATRIAS Through SLIP Based Human-inspired Control*, Cyber Physical Systems Week 2014, Berlin, Germany.

- *Exponential convergence of a unified CLF controller for robotic systems under parameter uncertainty*, American Control Conference 2014, Portland, Oregon, USA.

- *Composing Dynamical Systems to Realize Dynamic Robotic Dancing*, Workshop on Algorithmic Foundations of Robotics XI, Istanbul, Turkey.

- *Parameter Sensitivity and Boundedness of Robotic Hybrid Periodic Orbits*, Analysis and Design of Hybrid Systems 2015, Atlanta, Georgia, USA.

- *Time dependent control Lyapunov functions and hybrid zero dynamics for stable robotic locomotion*, American Control Conference 2016, Boston, Massachusetts, USA.

- *Bipedal robots: Bridging the gap between theory and experiment*, 2017, IIT Bombay, India.

- *Bipedal robots: Bridging the gap between theory and experiment*, 2017, IISc, Bengaluru, India.

- *History of Walking Robots*, 2017, IIT Bombay, India.

- *Legged Mechanisms as Farming Assistants*, 2018, CPCPRI, Kasaragodu, Kerala, India.

Reviewership

- Program committee member of Robots Science and Systems (RSS 2017, 2018).

- Program committee member of Safety Security and Rescue Robotics (SSRR 2012-2013).

- IEEE-TRO, IEEE-TAC, IEEE-LCSS, IEEE-RA-L, NAHS, IJRR.

- IROS, ICRA, CDC, ACC, ICC.