Saurav Kumar

Research Scientist II
Biomedical Technologies Division
University of Texas at Arlington Research Institute, TX, USA
+1-469-733-4937 sauravk@ieee.org https://sites.google.com/view/sauravkr/home

Education

PhD, Electrical Engineering August 2015 – August 2020
University of Texas at Dallas, TX, USA
- Advisors: Nicholas Gans, Robert D. Gregg
- Dissertation: "*Extremum Seeking Control of Autonomous Periodic Systems with Applications to Lower Limb Wearable Robots*"

M.Tech., Robotics (IT) July 2013 – June 2015
Indian Institute of Information Technology, Allahabad, India
- Advisor: Gora Nandi
- Dissertation: "*Multi-Objective Optimization Problem in Bipedal Locomotion*"

B.E., Electronics & Communication Engineering July 2008 – June 2012
Visvesvaraya Technological University (VTU), Belgaum, India

Research Experience

Research Scientist II July 2023 - Present
University of Texas at Arlington Research Institute, TX, USA *Supervisor: Dr. Muthu Wijesundara*

- Developed an automated posture recognition system for air cell-based smart seat cushion
- Contributed as key personnel in preparation of a grant proposal to UT System Trauma Research and Combat Casualty Care Collaborative

Postdoctoral Research Scholar January 2023 - June 2023
North Carolina State University, NC, USA *Supervisor: Dr. Hao Su*

- Analyzed the contribution of flexion/extension assistance modes for a bidirectional lower-limb exoskeletons
- Mentored PhD students and provided assistance in manuscript preparation

Postdoctoral Research Fellow September 2020 - December 2022
Carnegie Mellon University, PA, USA *Supervisor: Dr. Hartmut Geyer*

- Developed an adaptive spring loaded inverted pendulum model that walks across different terrains
- Mentored PhD student to develop a comprehensive swing leg motion predictor across locomotion modes
- Collaborated with North Carolina State University in the design and control of knee ankle prosthetic leg
- Assisted in the preparation of NSF grant proposal

Graduate Research Assistant August 2015 – August 2020
University of Texas at Dallas, TX, USA *Supervisor: Dr. Nicholas Gans, Dr. Robert Gregg*

- Developed a model-free optimization algorithm for auto-tuning of powered prosthetic legs
- Mentored team of undergraduate students in the development of quasi-passive ankle exoskeleton
- Assisted in laying out ideas and preliminary writeup of NSF grant proposal (CMMI-1728057)
- Collaborated with experts to design human-subject experiments and obtain IRB approval

Research Funding

National Science Foundation – CMMI (Award # 1728057) 09/01/2017 – 09/30/2021
Time-Invariant, Multi-Objective Extremum Seeking Control for Model-Free Auto-Tuning of Powered Prosthetic Legs *$ 373,483*

- Contributed to planning and writing of the grant proposal
- Developed preliminary work and aims for the proposal
- Prepared annual reports of the grant proposal

National Institutes of Health – CPS (Award # 5R01EB029765) 09/01/2019 – 08/31/2023
User and Environment Interactive Planning and Control of Artificial Lower Limbs for Resilient Locomotion *$ 364,867*

- Prepared annual report of the grant proposal

Trauma Research and Combat Casualty Care Collaborative 04/01/2024 – 07/31/2025
Adaptive Spine Board Overlay for Pressure Injury Prevention and Vibration Reduction during Long-range Aeromedical Evacuations *$ 450,734*

- Contributed to planning and writing of the grant proposal
- Developed preliminary idea and aims for the proposal

National Science Foundation
General Motion Predictor for Control of Lower-Limb Assistive Robots *under review*

- Contributed to writing of the first draft of grant proposal
- Developed preliminary work for the proposal

Research Interests

- Wearable Robots
- Prosthetics and Exoskeletons
- Legged Robots
- Optimization
- Nonlinear Control
- Biomechanics
- Bipedal Locomotion
- Modeling and Simulation

Academic Honors

- Best Student Paper Award Finalist, IEEE Conf. on Control Tech. & Applications, Hawaii, USA, 2017
- Graduate Aptitude Test in Engineering (GATE) Scholarship, India, 2013-2015
- Certificate of Excellence (Best Student), VTU, Belgaum, India, 2009
- Outstanding student of the year, VTU, Belgaum, India, 2008-2012

Publications

Peer-Reviewed Journal Articles

13. V. Erel, A. Palomino, A. Jamieson, I, Singh, **S. Kumar**, Y. Tzen, M. Wijesundara, "Development of an Adaptive Spine Board Overlay for Interface Pressure Reduction during Long-range Aeromedical Evacuation: Implication for Pressure Injury Prevention," submitted to *Journal of Rehabilitation and Assistive Technologies Engineering*, accepted.
12. **S. Kumar**, D. Sivasubramanian, I. Singh, A. Palomino, and M. Wijesundara, "Reducing Vibration Exposure for Medevac Patients with Real-time Vibration Control of Air Bladder Cushions," , submitted to *Sage Journal of Vibration & Control*, under review.
11. H. Xing, **S. Kumar**, and H. Geyer, "A Comprehensive Swing Leg Predictor for Unified Control of Prosthetic Legs Across Terrains," under preparation.
10. **S. Kumar**, P. Kashyap, S. Kongara, Y. Tzen, and M. Wijesundara, "Smart Seat Cushion Mobile Application with On-Device Posture Prediction Using TensorFlow Lite," submitted to *Disability and Rehabilitation: Assistive Technology*, under review.
9. **S. Kumar**, H. Geyer, "An Active Spring Mass Model with Biomimetic Ground Reaction Forces For Multiple Terrains," submitted to *IEEE Transactions on Biomedical Engineering*, under review.
8. **S. Kumar**, O. Makarenkov, R. Gregg, N. Gans, "Stability of Time-Invariant Extremum Seeking Control," in *IEEE Transactions on Automatic Control*, vol. 67, no. 9, pp. 5017-5024, 2022.

7. **S. Kumar**, M. Zwall, R. Gregg, N. Gans, "Extremum Seeking Control for Stiffness Auto-Tuning of a Quasi-Passive Ankle Exoskeleton," in *IEEE Robotics & Automation Letters*, vol. 5, no. 3, pp. 4604-4611, July 2020.
6. **S. Kumar**, A. Mohammadi, D. Quintero, S. Rezazadeh, N. Gans, R. Gregg, "Extremum Seeking Control for Model-Free Auto-Tuning of Powered Prosthetic Legs," in *IEEE Transactions on Control Systems Technology*, vol. 28, no. 6, pp. 2120-2135, 2019.

Peer-Reviewed Conference Proceedings

5. H. Xing, **S. Kumar**, H. Geyer, "Comprehensive Swing Motion Predictor for Steady and Transient Walking Conditions," *IEEE International Conference on Robotics & Automation*, Philadelphia, pp. 5686-5692, 2022.
4. **S. Kumar**, A. Mohammadi, R. Gregg, N. Gans, "Limit Cycle Minimization by Time-Invariant Extremum Seeking Control," *American Control Conference*, Philadelphia, pp. 2359-2365, 2019.
3. **S. Kumar**, A. Mohammadi, N. Gans, R. Gregg, "Automatic Tuning of Virtual Constraint-based Control Algorithms for Powered Knee-Ankle Prostheses," *IEEE Conference on Control Technology and Applications*, Hawaii, pp. 812-817, 2017. **Best Student Paper Finalist.**
2. **S. Kumar**, N. Gans, "Extremum Seeking Control for Multi-Objective Optimization Problems," *IEEE Conference on Decision & Control*, Las Vegas, NV, pp. 1112-1118, 2016.
1. **S. Kumar**, S. Sonkar, M. Raj and G. C. Nandi, "ZMP based feedback control of ankle joint," *International Conference on Industrial Instrumentation and Control (ICIC)*, pp. 1032-1037, 2015.

Posters

1. "Extremum Seeking Control for Model-Free Auto-Tuning of Powered Prosthetic Legs," *International Conference on Robotics & Automation*, 2018.
2. "Time-Invariant Extremum Seeking Control," *American Control Conference*, 2020.
3. "Real-Time Vibration Control of Air-Bladder Cushions for Medical Evacuation," *UTA Research Institute Research Day*, 2025.
4. "Personalized Posture Prediction via On-Device Training for Wheelchair Users," *UTA Research Institute Research Day*, 2025.

Graduate Coursework

- Linear Systems
- Convex Optimization
- Nonlinear Systems
- Robust Control
- Robot Control
- Modeling and Simulation
- Elementary Analysis - I
- Elementary Analysis - II
- Stability and Bifurcation of Switched Systems
- Optimal Estimation & Kalman Filtering
- Mathematical Foundation of Robotics
- Computational Intelligence
- Soft Computing
- Image Processing
- Humanoid Robotics
- Robot Motion Planning

Advising & Mentoring

- **Dhanush Sivasubramanian**, MS student, University of Texas at Arlington, 2025
- **Ram Prasad Reddy Gajjala**, MS student, University of Texas at Arlington, 2025
- **Snehith Kongara**, MS student, University of Texas at Arlington, 2024
- **Pranav Kashyap Gujja**, MS student, University of Texas at Arlington, 2024
- **Anirudh Sai Khande Rao**, MS student, University of Texas at Arlington, 2023-2024
- **Sai Priyanka Sanku**, MS student, University of Texas at Arlington, 2023
- **Junxi Zhu**, PhD student, North Carolina State University, 2022-2023
- **Sainan Zhang**, PhD student, North Carolina State University, 2023
- **Haosen Xing**, PhD student, Carnegie Mellon University, 2020-2022
- **Haoran Ma**, MS student, Carnegie Mellon University, 2022
- **Manan Shah**, MS student, Carnegie Mellon University, 2021
- **John D. Vakidis**, M.S. student (Mechanical Engineering), UT Dallas, 2019.
- Mentored Undergraduate Senior Design Team on "*Real-Time Optimization of Ankle Exoskeleton Using Variable Stiffness Actuators*", UT Dallas, 2018-2019. **(Best Infographic Award)**

Scholarly Service

Conference Organization Committee

- Organizer of "*Extremum Seeking Control for Biomedical Application*" Workshop, American Control Conference, Colorado, 2020, https://sites.google.com/view/esc4biomed/home
- Member of organizing committee at *IEEE Conference on Control Technology and Applications*, Hawaii, 2017
- Program committee member of *Pervasive Technologies Related to Assistive Environments* (PETRA) Conference, Greece, 2023

Outreach

- Locomotor Control System Laboratory Tour, Explore Engineering Day, February, 2019
- Demo of UTD prosthetic leg control, Engineer's week, January, 2018

Reviewer

- National Science Foundation (NSF)
- American Control Conference
- Modeling, Estimation and Control Conference, International Federation of Automatic Control
- IEEE Conference on Control Technology & Applications
- Automatica, International Federation of Automatic Control
- Journal of NeuroEngineering & Rehabilitation, Springer Nature
- IEEE International Conference on Robotics & Automation
- IEEE International Conference on Intelligent Robots & Systems
- IEEE International Conference on Biomedical Robotics and Biomechatronics
- IEEE Transactions on Neural Systems & Rehabilitation Engineering
- IEEE Transactions on Automatic Control
- IEEE Transactions on Control Systems Technology
- PErvasive Technologies Related to Assistive Environments (PETRA)

Training & Certifications

- Participated in NSF Online Virtual Grant Conference, 2023.
- Participated in an online NSF workshop from Grant Training Center, 2023
- National Institutes of Health (NIH) Course on "*Protecting Human Research Participants*," 2017
- Responsible Conduct of Research, University of Texas at Dallas, 2017
- Responsible Conduct of Research, Carnegie Mellon University, 2021
- Collaborative Institutional Training Initiative Program – Biomedical Research, Carnegie Mellon University, 2021

References

Hartmut Geyer, PhD
hgeyer@cs.cmu.edu
+1-412 268-1724
Associate Professor
Robotics Institute
Carnegie Mellon University

Nicholas Gans, PhD
ngans@uta.edu
+1-817-272-5850
Associate Professor
Department of Computer Science and Engineering
University of Texas at Arlington

Robert D. Gregg, PhD
rdgregg@umich.edu
+1-734-763-1156
Professor
Department of Electrical Engineering & Computer Science
University of Michigan, Ann Arbor

Oleg Makarenkov, PhD
makarenkov@utdallas.edu
+1-972-883-4617
Associate Professor
Department of Mathematical Sciences
University of Texas at Dallas

Muthu Wijesundara, PhD
muthuw@uta.edu
+1-817-272-5994
Division Head of Biomedical Technologies
University of Texas at Arlington Research Institute
University of Texas at Arlington

Shishir Kolathaya, PhD
shishirk@iisc.ac.in
+91-80-2360-0644
Assistant Professor
Department of Computer Science and Automation
Indian Institute of Science