

Shubham Singh

A roboticist skilled in dynamic locomotion, optimization, estimation, controls & effective communication. Quickly adapts to the needs of the task, enjoys working in a team, likes to lead.

Education

- Expected June'23 **PhD in Aerospace Engineering, Dynamics & Control, The University of Texas at Austin, TX**
Relevant Courses: Human Centered Robotics, Optimal Control Theory, Statistical Estimation
- 2016 **MS in Aerospace Engineering, Purdue University, IN**
- 2014 **B.Tech in Mechanical Engineering, Delhi Technological University, India**

Research/Work Experience

- May –Aug'22 **Robotics Research Intern, Flexiv Robotics, CA**
- Benchmarked a contact-aware MPC controller on a 7-DoF manipulator
- Simulation using PyBullet, GramPC, Pinocchio, and communication using the LCM tool.
- Skills used- Trajectory Optimization, Model Predictive Control, C++, Python
- June'20– **Data Scientist, AI Research Lab, Dell, Austin**
- July'20 - Worked towards automation of Data-Driven Data Centers
- Skills used- Reinforcement Learning, Deep Learning, Tensorflow, DockerHUB
- August'18– **Graduate Research Assistant, The University of Texas at Austin**
- Theoretical and algorithmic contribution to the dynamic modeling of robots using Featherstone's Spatial-Vector Algebra
- Working on developing model-based control algorithms for legged robots. Contributing code to open-source C++ library Pinocchio
- Skills used- Trajectory Optimization, Spatial Vector Algebra, C++, Fortran
- June'15– **Graduate Research Assistant, Rapid Design of Systems Lab, Purdue University**
- December'17 - Implementing indirect trajectory optimization methods for Hypersonic mission design
- Part of the NASA Human Space Exploration Mission Systems Architecture research
- Skills used- Hypersonic Missile Trajectory Optimization, Mission Design
- June'13– **Summer Research Intern, Turbulence Research Lab, University of Toronto**
- August'13 - Skills used- LABview, Hardware/software integration

Publications

1. **Singh, S.**, Russell, R. P., & Wensing, P. M., *Analytical Second-Order Partial Derivatives of Rigid-Body Inverse Dynamics*, 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 11781-11788, doi: 10.1109/IROS47612.2022.9981356.. (Pre-print) (Code)
2. **Singh, S.**, Russell, R. P., & Wensing, P. M. , *Efficient Analytical Derivatives of Rigid-Body Dynamics using Spatial Vector Algebra.*, in IEEE Robotics and Automation Letters, vol. 7, no. 2, pp. 1776-1783, April 2022, doi: 10.1109/LRA.2022.3141194, presented at ICRA 2022. (Pre-print) (Code)
3. Russell, R., **Singh, S.**, & Wensing, P. (2019). *Advancing the Runtime and Robustness of Differential Dynamic Programming*. Workshop: Toward Online Optimal Control of Dynamic Robots, ICRA, Montreal, Canada.

4. **Singh, S.**, & Grant, M. (2018). *The use of Homotopy Analysis Method for indirect trajectory optimization*. Scitech AIAA, Kissimmee, Florida. (Paper)
5. O'Neill, W., Guariniello, C., Das-Stuart, A., Mall, K., **Singh, S.**, & Delaurentis D., (2017). *Application Of A Top Down System-of Systems Approach To Enable Human Mars Exploration Missions*. International Astronautical Congress, Adelaide, Australia. (Paper)
6. **Singh, S.** (2016). Applications of the homotopy analysis method to optimal control problems. Purdue University. (Thesis)
7. **Singh, S.**, & Zunaïd, M. (2014). Numerical Study of the Generic Sports Utility Vehicle Design with a Drag Reduction Add-On Device. Journal of Computational Engineering, Hindawi. (Paper)

Achievements & Awards

- March'22, **IEEE RAS Travel Award (ICRA, IROS 2022)**, *IEEE, Robotics and Automation Society*
- Sept'22
- Feb, Sept'22 **UT Austin Graduate Professional Travel Award**, *Graduate School, UT Austin*
- August'21, **Warren A. and Alice L. Meyer Endowed Scholarship in Engineering**, *Cockrell School of Engineering Scholarship, UT Austin*
- July'22
- May'17 **AIAA Graduate Mission Design Competition 2016-17** , *Third Place for Mid-Tier Defense Against Hypersonic Glide Vehicles (Team-Lead, Purdue University)*
- June'13 **MITACS Globalink Scholarship, Canada**, *Summer Research Intern, University of Toronto*
- May'11 **Merit Scholarship, Mechanical Engineering**, *Undergraduate Student, Delhi Technological University*

Professional Activities/Volunteering

- Nov'22 **Reviewer**, *IEEE ICRA 2023*
- Nov'22- **Reviewer**, *IEEE Robotics and Automation Letters*

Skills

, *Programming Skills:*

- **Fortran 90/77 (Libraries-BLAS,MKL)**, **C++ (Libraries-Eigen)**, **Python (Tensorflow, Numpy)**
- **Mathematica, Maple**: Symbolic Manipulators
- **SOLIDWORKS, CATIA, Pro-Engineer, AutoCAD**: CAD Tools
- **STK-AGI,MATLAB & Simulink, LATEX**: Engineering/Type-setting Software

, *Technical Skills:*

- Expertise in Design Optimization (IPOPT/SNOPT), Optimized based Robotics, Dynamic Locomotion, Machine/Reinforcement Learning, ROS, Physics simulation engines (PyBullet), Version control (Git).

, *Non-Technical Skills:*

- Public Speaking and Effective Communication- Member of UT Science Toastmasters

References

1. Dr. Ryan P. Russell (Ph.D. Supervisor)- Professor, Aerospace Engineering & Engineering Mechanics, The University of Texas at Austin, contact - ryan.russell@austin.utexas.edu
2. Dr. Patrick M. Wensing - Assoc. Professor, Aerospace & Mechanical Engineering, University of Notre Dame, contact - pwensing@nd.edu
3. Dr. Michael J. Grant (M.S. Supervisor) - Sandia National Laboratory, contact - mjgrant@purdue.edu