

Shubham Singh

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

Education

- Expected Dec' 22 **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, Systems Engineering, Purdue University, IN**
Relevant Courses: Multidisciplinary Design Optimization, System of Systems
- 2014 **B.Tech in Mechanical Engineering, Delhi Technological University, India**

Research/Work Experience

- May'22– **Robotics Research Intern, Flexiv Robotics, CA**
- Present - Worked towards Model Predictive Controllers for Manipulators
- 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**
- Part of the NSF project 1835013 “EAGER/Collaborative Research: Unlocking Legged Mobility Through Structured Prediction”
- Skills used- Trajectory Optimization, Robotics control, Spatial Vector Algebra, C++, Fortran
- August'15– **Graduate Research Assistant, System of Systems Lab, Purdue University**
- December'17 - Part of the NASA Human Space Exploration Mission Systems Architecture research project
- Skills used- Network theory, Data Analysis
- June'15– **Graduate Research Assistant, Rapid Design of Systems Lab, Purdue University**
- December'17 - Implementing indirect trajectory optimization methods for Hypersonic mission design
- 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. , *Closed-Form Second-Order Partial Derivatives of Rigid-Body Inverse Dynamics*, Accepted for IROS 2022. (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. (Pre-print) (Code)
3. **Singh, S.**, Russell, R. P., & Wensing, P. M. , *Efficient Analytical Derivatives of Rigid-Body Dynamics using Spatial Vector Algebra.*, at ICRA 2022, Philadelphia, PA.

4. 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. (Slides)
5. **Singh, S.**, & Grant, M. (2018). *The use of Homotopy Analysis Method for indirect trajectory optimization*. Scitech AIAA, Kissimmee, Florida. (Paper)
6. 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)
7. **Singh, S.** (2016). Applications of the homotopy analysis method to optimal control problems. Purdue University. (Thesis)
8. **Singh, S.**, & Zunaid, 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**, *IEEE, Robotics and Automation Society*
- Feb'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 *School of Engineering Scholarship, UT Austin*
- 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*

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
- **FLUENT, STK-AGI, LABview, LATEX:** Commerical Engineering/Type-setting Software
- **MATLAB & Simulink:** Expertise in MATLAB programming

, *Technical Skills:*

- Expertise in Design Optimization (IPOPT/SNOPT), Systems Engineering, Dynamics & Controls, 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
- Scientific Communication- Scientist in Residence (2018), UT Environmental Science Institute

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 - Asst. 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