

Shubham Singh

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

Education

- Ongoing **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**, West Lafayette, IN.
Relevant Courses: Multidisciplinary Design Optimization, System of Systems
- 2014 **B.Tech in Mechanical Engineering**, *Mechanical Engineering*, **Delhi Technological University**, Delhi, India.

Research/Work Experience

- June'20– **Data Scientist**, *AI Research Lab*, **Dell**, *Austin*.
July'20
 - Part of the AI research team as a summer intern
 - 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. (under preparation). *Second order analytical derivatives of rigid body dynamics*.
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. Preprint: (Link) (Code)
3. **Singh, S.**, Russell, R. P., & Wensing, P. M. , *Efficient Analytical Derivatives of Rigid-Body Dynamics using Spatial Vector Algebra.*, Accepted for ICRA 2022.
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. (Link)

5. **Singh, S.**, & Grant, M. (2018). *The use of Homotopy Analysis Method for indirect trajectory optimization*. Scitech AIAA, Kissimmee, Florida. (Link)
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. (Link)
7. **Singh, S.** (2016). Applications of the homotopy analysis method to optimal control problems. Purdue University. (Link)
8. **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. (Link)

Achievements & Awards

- August'21 **Warren A. and Alice L. Meyer Endowed Scholarship in Engineering, Cockrell 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,Pinocchio), 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