Alap Kshirsagar

Official e-mail: ak2458@cornell.edu
Personal e-mail: alapkshirsagar@gmail.com
Webpage: http://alapkshirsagar.github.io/

EDUCATION

Doctor of Philosophy (PhD), Mechanical Engineering Aug 2017 – Present
Cornell University
Research Area: Human-Robot Interaction
Committee: Prof. Guy Hoffman (Chair), Prof. Hadas Kress-Gazit, Prof. Mark Campbell
GPA: 4/4 (8 semesters)
Academic Year 2019-20 at Ben-Gurion University of the Negev (BGU), Israel

Master of Technology (MTech), Mechanical Engineering Jul 2015 – May 2017
Indian Institute of Technology-Madras (IITM)
Specialization: Mechanical Design
CGPA: 9.07/10
Winter Semester 2016-17 at Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen, Germany

Bachelor of Technology (BTech Honours), Mechanical Engineering Jul 2010 – Apr 2014
Indian Institute of Technology-Bombay (IITB)
Minor: Aerospace Engineering
CGPA: 8.78/10

KEY AWARDS/SCHOLARSHIPS

- *Research Academic Internship Scholarship* by 'Israeli Council for Higher Education' 2019
- *IIT Master Sandwich Scholarship* by 'German Academic Exchange Service (DAAD)'
- *S.N. Bose Scholarship* by 'Indo-US Science and Technology forum' 2016
- *Gandhian Young Technological Innovation Award* by 'Society for Research and Initiatives for Sustainable Technologies and Institutions, India' 2013
- *Institute Technical Special Mention*, awarded to 12 out of 7000 students, for notable contribution in robotics activities at IIT Bombay 2012
- *Top 1%* in National Standard Examination in Physics, Chemistry and Astronomy 2010
- KVPY (*Kishore Vaigyanik Protsahan Yojana or Young Scientist Initiative*) fellowship, initiated by Department of Science and Technology, Govt. of India 2010
- *National Talent Search Scholarship* by NCERT, Govt. of India, awarded to top 750 students in the country on the basis of 3 tier examination 2008

PUBLICATIONS/PRESENTATIONS

Book Chapters

- G. Hoffman, **A. Kshirsagar** and M. Law. "Human-Robot Interaction Challenges in the Workplace." *The Psychology of Technology: Social Science Research in the Age of Big Data, edited by Sandra Matz*, APA, 2022 (in-press)

Journal Articles

- T. Faibish*, **A. Kshirsagar***, G. Hoffman and Y. Edan. "Human Preferences for Robot Eye Gaze in Human-to-Robot Handovers." *International Journal of Social Robotics*, 2022 (*co-first author, in-press)
- **A. Kshirsagar**, G. Hoffman and A. Biess. "Evaluating Guided Policy Search for Human-Robot Handovers." *IEEE Robotics and Automation Letters* 6 (2): 3933-3940, 2021
- **A. Kshirsagar**, M. Lim, S. Christian and G. Hoffman. "Robot Gaze Behaviors in Human-to-Robot Handovers." *IEEE Robotics and Automation Letters* 5(4):6552-6558, 2020

- **A. Kshirsagar** and A. Guha. “Design optimization of rocker bogie system and development of look-up table for reconfigurable wheels for a planetary rover.” *International Journal of Vehicle Structures and Systems*, 8.2:58-66, 2016
- S. Loharkar, **A. Kshirsagar** and R. Pant. “Design and Fabrication of a portable semi-rigid airship.” *Annual Technical Volume of Aerospace Engineering Division Board, Institution of Engineers (India)*, 2015-16

Conference Proceedings

- **A. Kshirsagar**, H. Kress-Gazit and G. Hoffman. “Specifying and Synthesizing Human-Robot Handovers.” *IEEE/RSJ International Conference on Intelligent Systems and Robots (IROS)*, Macau, 4-8 November 2019
- **A. Kshirsagar**, B. Dreyfuss, G. Ishai, O. Heffetz and G. Hoffman. “Monetary-Incentive Competition between Humans and Robots: Experimental Results.” *ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Daegu, South Korea, 11-14 March 2019
- **A. Kshirsagar,** R. Pant and K. Bodi. “Dynamic simulation of breakaway aerostat with emergency deflation valves.” *16th AIAA Aviation Technology, Integration and Operations Conference*, AIAA Aviation, Washington D.C., USA, 13-17 June 2016
- **A. Kshirsagar**, D. Harursampath and B. R. Gupta. “VAM applied to Dimensional Reduction of Non-linear Multifunctional Film Fabric Laminates.” *12th International Conference of Numerical Analysis and Applied Mathematics*, Rhodes, Greece, 22-28 September 2014
- **A. Kshirsagar**, A. Tejwani, V. Singh, G. Bhat, N. Singh, A. Yadav, A. Berlia, K. Saboo, U. Patil and S. Prasad. “Mechatronic Design, Fabrication and Analysis of a Small-Size Humanoid Robot-Parinat.”, *International Conference on Design, Manufacturing and Mechatronics*, Pune, India, April 2014

Workshops/Late-breaking Reports

- **A. Kshirsagar**, H. Kress-Gazit and G. Hoffman. “Human-Robot Handovers with Signal Temporal Logic Specifications.” *IEEE International Conference on Robot and Human Interactive Communication*, New Delhi, India, 14-18 October 2019 (Best Late Breaking Report Award)
- **A. Kshirsagar**, V. Sharma and R.S. Pant. “Design and Development of a Dismantable Semi Rigid Remotely Controlled Airship.” *10th International Airship Convention and Exhibition*, Friedrichshafen, Germany, 16-18 April 2015
- A. Rajagopal, P. Bende, S. Yadav, R. Agarwal and A. Sathawane, **A. Kshirsagar**, M.C. Hemanth, N. Kumar, P. Gatkine. “Design, Modelling and Control of a 6 Degrees of Freedom Robotic Arm with specific applications in Planetary Exploration Missions.” *65th International Astronautical Congress*, Toronto, Canada, 29 September-3 October 2014

RESEARCH EXPERIENCE

Graduate Research Assistant, Cornell University, USA Aug 2017 – Present

- **Bimanual Human-Human and Human-Robot handovers**
  PI: Prof. Guy Hoffman (Cornell)
  Developing human motion models and robot controllers for bimanual handovers in a shelving task

- **Self-handovers with a Wearable Robotic Third Arm**
  PI: Prof. Guy Hoffman (Cornell)
  Developing reactive controllers for object handovers and collision avoidance with a supernumerary arm

- **Gaze Behaviours in Human-Human and Human-Robot Handovers**
  PI: Prof. Guy Hoffman (Cornell), Prof. Yael Edan (BGU)
  Investigated the gaze behaviors of receivers in human-to-human and human-to-robot handovers

- **Specifying and Synthesizing Human-Robot Handovers**
  PIs: Prof. Guy Hoffman (Cornell), Prof. Hadas-Kress Gazit (Cornell)
  Proposed a robot controller for human-robot handovers with formal specifications written in STL

- **Interactive Fabrication with Augmented Reality and a Robotic 3D Printer**
  PIs: Dr. Huaishu Peng (Cornell), Prof. François Guimbretière (Cornell), Prof. Guy Hoffman (Cornell)
  Conducted a user study of an interactive fabrication system with an augmented reality CAD editor and a robotic arm 3D printer

- **Economic Decision Making with a Robot**
  PIs: Prof. Guy Hoffman (Cornell), Prof. Ori Heffetz (Cornell and HUJI)
  Conducted user studies of human decision making in the presence of robots when there are monetary rewards at stake

Visiting Doctoral Researcher, BGU, Israel Oct 2019 – Aug 2020

- **Guided Policy Search for Human-Robot Handovers**
  PIs: Dr. Armin Biess (BGU-Israel), Prof. Guy Hoffman (Cornell)
  Evaluated controllers learnt with Guided Policy Search for human-robot handovers in MuJoCo and with physical Franka-Emika Panda robot

Master's thesis, RWTH Aachen, Germany and IIT Madras, India Aug 2016 – May 2017

- **iGPS based motion control of robotic manipulator using Robot Operating System (ROS)**
  PIs: Univ.-Prof. Burkhard Corves (RWTH), Dr. Sourav Rakshit (IITM)
  Devised algorithms for accurate control of robotic manipulators using indoor GPS (iGPS) feedback and tested them in Gazebo and on physical UR-5 robot

Visiting Student Researcher, University of California Berkeley, USA May 2016 – Jul 2016

- **Robotic manipulation of deformable objects**
  PI: Prof. Masayoshi Tomizuka (UCB)
  Developed simulation of 1-D deformable object manipulation tasks by industrial robots FANUC LRmate200iD, using Remote Application Programming Interface (API) between V-REP and MATLAB

Junior Research Fellow, IIT Bombay, India Sep 2014 – Jun 2015

- **Trajectory simulation of breakaway aerostat**
  PI: Prof. Rajkumar Pant (IITB)
  Developed MATLAB simulations of ascent and descent trajectory of a tethered aerostat after accidental tether breakage, to predict performance of payload recovery device

- **Design and development of a dismantle-able semi rigid airship**
  PI: Prof. Rajkumar Pant (IITB)
  Built a prototype of remotely controlled semi-rigid airship with a dismantle-able frame to provide structural strength and ability to mount propulsion units on off-gondola locations

B.Tech. Project, IIT Bombay, India Aug 2013 – Apr 2014

- **Design Optimization and Motion Dynamics of Mobility System for Mars Rover**
  PI: Prof. Anirban Guha (IITB)
  Analysed the effect of wheel dimensions on mobility performance of rocker bogie system and devised look-up tables for autonomous reconfiguration of wheel dimensions

Summer Research Internship, IISc Bangalore, India May 2013 – Jul 2013

- **VAM based modelling of Film-Fabric Laminates**
  PI: Prof. Dineshkumar Harursampath (IISc)
  Developed asymptotically correct constitutive model of multi-layered film-fabric laminates with potential application in reliable design of High-Altitude Airship envelopes

Student Investigator, IIT Bombay, India Jan 2012 – Nov 2013

- **Design of Fabric Cutting Machine for Mat-making Handlooms**
  PI: Prof. Suhas Joshi (IITB)
  Designed and tested various prototypes of human powered as well as electric fabric cutting machine to increase the productivity of mat-making handlooms operated by visually challenged people

STUDENT TEAM PROJECTS

Mars Rover Team, IIT Bombay, India Feb 2013 – May 2014

- Led the 10-member Mechanical sub-system
- Designed and manufactured rover's mobility system as well as robotic arm to accomplish various mission objectives like astronaut assistance, sample collection, equipment servicing and terrain traversing
- Participated in Arkaroola Mars Robot Challenge-2014, a 14-day expedition organized by Mars Society Australia and Saber Astronautics in Arkaroola Wilderness Sanctuary, Australia

'Parinat' – Bipedal Robot Team, IIT Bombay, India Sep 2012 – May 2014

- Led the 12-member Mechanical sub-system
- Conceptualized and built a small size humanoid robot with 12 degrees of freedom

TEACHING/MENTORING EXPERIENCE

Teaching Assistant

- **Mechanical Synthesis, Cornell University** Spring 2021
  Instructor: Prof. Guy Hoffman
  Taught two topics in the course, supervised team of 15 UG teaching assistants, helped in preparing assignments and demonstration kits, assisted in grading

- **Human-Robot Interaction: Algorithms and Experiments, Cornell University** Fall 2018
  Instructor: Prof. Guy Hoffman
  Helped prepare assignments and exams, held office hours, graded assignments

Mentored Students in Research

Tair Faibish (MSc, Industrial Engineering, BGU)	Jan 2020 – Dec 2021
Rahul Kumar Ravi (MS, Mechanical Engineering, Cornell)	Jan 2021 – Dec 2021
Jordana Socher (BS, Computer Science, Cornell)	Mar 2021 – Dec 2021
David Bruk-Rodriguez (BS, Biomedical Engineering, Cornell)	Mar 2021 – Dec 2021
Raphael Fortuna (BS, Electrical Engineering, Cornell)	Sep 2021 – Dec 2021
Sophie Keller (BS, Computer Science, Cornell)	Sep 2021 – Dec 2021
Cole Dawson (BS, Mechanical Engineering, Cornell)	Mar 2021 – May 2021
Mohammad Ali Moghaddasi (BS, Mechanical, Cornell)	Mar 2021 – May 2021
Melanie Lim (MEng, Systems Engineering, Cornell)	Apr 2019 – Apr 2020
Shemar Christian (BS, Mechanical Engineering, Cornell)	Apr 2019 – Apr 2020
Julie Katz (MPS, Information Science, Cornell)	Feb 2019 – May 2019
Song Ye (MPS, Information Science, Cornell)	Feb 2019 – May 2019
Lucia Gomez (BS, Computer Science, Cornell)	Sep 2018 – Dec 2018

TECHNICAL SKILLS

Programming	Robot Operating System, Python, C++, MATLAB, Mathematica, Arduino
Robots	Kinova Gen3, Kinova Jaco2, Franka-Emika Panda, Sawyer, UR-5, WidowX Mark III
CAD packages	Solidworks, Autodesk Inventor, AutoCAD
Simulation tools	MuJoCo, Gazebo, V-REP, Autodesk Nastran, Ansys, Autodesk Simulation Multiphysics, MSC/ Adams View
Documentation	LaTeX
Languages	English (Fluent), Hindi (Fluent), Marathi (Native), Sanskrit (Beginner)

RELEVANT COURSES

Robotics	∘ Human-Robot Interaction ∘ Mechatronic Systems	∘ Formal Methods for Robotics ∘ Mechanics and Control of Robot Manipulators
Mechanical Engineering	∘ Product Design ∘ Machine Design	∘ Micro-Electro-Mechanical Systems ∘ Kinematics and Dynamics of Machines
EE/CS	∘ Computer Vision ∘ Artificial Intelligence	∘ Machine Learning for Intelligent Systems ∘ Advanced Machine Learning
Aerospace Engineering	∘ Spaceflight Mechanics ∘ Aircraft Design	∘ Aerospace Propulsion ∘ Spaceflight Navigation and Guidance
Mathematics	∘ Differential Equations ∘ Linear Algebra	∘ Numerical Analysis ∘ Data Interpretation and Analysis