Curriculum Vitae

Alap Kshirsagar

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EDUCATION

Postgraduate	**Indian Institute of Technology-Madras (IITM)** • Master of Technology (MTech), Mechanical Engineering • Specialization: Mechanical Design • CGPA: 9.12/10 (upto 2 semesters) • *Winter Semester 2016-17 at RWTH Aachen, Germany*	July 2015-Present
Undergraduate	**Indian Institute of Technology-Bombay (IITB)** • Bachelor of Technology (BTech, Honours), Mechanical Engineering • Minor: Aerospace Engineering • CGPA: 8.78/10	July 2010-April 2014

KEY AWARDS/ACHIEVEMENTS

- *IIT Master Sandwich scholarship* by 'German Academic Exchange Service *(DAAD)'* 2016
- *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
- *All India Rank 289* in IIT-Joint Entrance Examination amongst 470,000 candidates 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

RESEARCH EXPERIENCE

Master's thesis, RWTH Aachen and IIT Madras — September 2016-Present

Project Topic: iGPS based motion control of robotic manipulator using Robot Operating System (ROS)
German Advisor: Univ.-Prof. Burkhard Corves, Institut für Getriebetechnik und Maschinendynamik
Indian Advisor: Dr. Sourav Rakshit, Mechanical Engineering Department

- Devised algorithms for accurate control of robotic manipulator using indoor GPS (iGPS) feedback
- Developed ROS packages for iGPS based motion control of Universal Robot-5 manipulator
- Evaluated accuracy of iGPS based motion control algorithms using Gazebo model and actual UR-5 robot

Visiting Student Researcher, MSC Lab, University of California Berkeley — May 2016 – July 2016

Project Topic: Robotic manipulation of deformable objects
Advisor: Prof. Masayoshi Tomizuka, Cheryl and John Neerhout, Jr. Distinguished Professor

- Developed a novel image processing algorithm to extract tangent space data from digital colour images of one dimensional (1-D) deformable objects like ropes, wires etc.
- Built framework in MATLAB for obtaining manipulation trajectory of 1-D deformable objects during 'robot learning from demonstration' scenarios
- 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, Lighter-Than-Air Systems Lab, IIT Bombay September 2014 – June 2015
Advisor: Prof. Rajkumar Pant, Aerospace Engineering Department
Project 1: Trajectory simulation of breakaway aerostat
- Developed a MATLAB code for trajectory simulations of ascent and descent of a tethered aerostat after accidental tether breakage, to predict performance of payload recovery device

Project 2: Design and development of a dismantle-able semi rigid airship
- Designed and 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 August 2013- April 2014
Project Topic: Design Optimization and Motion Dynamics of Mobility System for Mars Rover
Advisor: Prof. Anirban Guha, Mechanical Engineering Department
- Evaluated and compared the performance of various mobility systems based on metrics like obstacle climbing capability, power consumption and effective ground pressure
- Developed a physics based motion dynamics simulation tool in MATLAB, incorporating the forward dynamics of rocker bogie system, wheel-soil interaction mechanics and drive motor characteristics
- 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, NMCAD Lab, IISc Bangalore May 2013- July 2013
Project Topic: VAM based modelling of Film-Fabric Laminates
Advisor: Prof. D. Harursampath, Aerospace Engineering Department
- Developed asymptotically correct constitutive model of multi-layered film-fabric laminates with potential application in reliable design of High Altitude Airship envelopes
- Conducted independent research built upon two separate methodologies developed for hyperelastic shells and composite sandwich plates by former doctoral and masters students of lab
- Implemented the nonlinear 3-D hyperelastic shell formulation for 3 layers followed by dimensional reduction based on Variational Asymptotic Method, using MATHEMATICA

Student Investigator, RuTAG, IIT Bombay Jan 2012- Nov 2013
Project Topic: Design of Fabric Cutting Machine for Mat-making Handlooms
Advisor: Prof. Suhas Joshi, Mechanical Engineering
- Designed, fabricated 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
- Selected for funding from 'Rural Technology Action Group' (RuTAG) initiated by Principle Scientific Advisor to Govt. of India.

MAJOR STUDENT PROJECTS

Mars Society-India , Executive Member and Head of Mechanical Subsystem Feb 2013 – May 2014
- Led the 10-member Mechanical sub-system of IITB Rover project
- 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, to test the rover's capabilities

'Parinat', Head of Mechanical Subsystem Sept 2012-May 2014
- Led the 12 member Mechanical sub-division of IIT Bombay's first student humanoid robot project
- Conceptualized and built a small size humanoid robot with 12 degrees of freedom, capable of demonstrating basic human motions like straight walking and turning
- Performed motion simulations and stress analysis of detailed CAD models of robot for deciding actuator torque requirements and gait sequence

PUBLICATIONS/PRESENTATIONS

- **A. Kshirsagar**, T. Tang, M. Tomizuka, *"An Image Processing Algorithm for Robotic Manipulation of One Dimensional Deformable Objects"*, submitted for review, 13th Conference on Automation Science and Engineering (CASE), 2017
- **A. Kshirsagar,** 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
- **A. Kshirsagar,** R. Pant, 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.
- S. Loharkar, **A. Kshirsagar,** R.S. Pant, *"Design and Fabrication of a portable semi-rigid airship"*, Annual Technical Volume of Aerospace Engineering Division Board, Institution of Engineers (India), 2015-16
- **A. Kshirsagar**, V. Sharma, 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, 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
- **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, S. Prasad, *"Mechatronic Design, Fabrication and Analysis of a Small-Size Humanoid Robot-"Parinat"*, International Journal of Current Engineering and Technology, April 2014, 58-62

PROFESSIONAL MEMBERSHIPS

- Student Member, American Institute of Aeronautics and Astronautics (AIAA)
- Nominee, AIAA Lighter-Than-Air Systems Technical Committee

TECHNICAL SKILLS

Programming	Robot Operating System, C++, MATLAB, Mathematica, Arduino
CAD packages	Creo, Solidworks, Autodesk Inventor, AutoCAD
Simulation tools	V-REP, Gazebo, ANSYS, Autodesk Simulation Multiphysics, MSC/ Adams View
Documentation	LATEX

RELEVANT COURSES

Mechanical Engineering	o Mechatronic Systems o Product Design o Finite Element Methods o Machine Design	o Mechanics and Control of Robot Manipulators o Micro-Electro-Mechanical Systems o Microprocessors and Automatic Control o Kinematics and Dynamics of Machines
EE/CS	o Computer Vision o Artificial Intelligence	o Computer programming and utilization o Intro. to Electrical and Electronic Circuits
Aerospace Engineering	o Spaceflight Mechanics o Aircraft Design	o Aerospace Propulsion o Spaceflight Navigation and Guidance
Mathematics	o Differential Equations o Linear Algebra	o Numerical Analysis o Data Interpretation and Analysis