

# ADITYA PRATAP SINGH RAJAWAT

DUAL DEGREE, IIT KANPUR

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## EDUCATION

2020	<b>Indian Institute of Technology Kanpur</b> <i>B.Tech - M.Tech Dual in Mechanical Engineering</i>	P.G. - 10/10, U.G. - 8.9/10
2015	<b>MDS Senior Secondary School, Udaipur</b> <i>Higher Secondary Examination, Central Board of Secondary Education</i>	94.6%
2013	<b>Central Academy, Sardapura, Udaipur</b> <i>Secondary Examination, Central Board of Secondary Education</i>	C.G.P.A. - 10/10

## SCHOLASTIC ACHIEVEMENTS

2019	Received <b>A*</b> (top 1%) grade for exceptional performance in the course "Machining Dynamics"
2018	Received <b>A*</b> grade in the course "Railroad Vehicle Dynamics"
2018	Awarded Halliburton Engineering Global Programs Scholarship to participate in TAMU Exchange Program
2018	Awarded <b>Tarun Sondhi Memorial Scholarship</b> on Merit basis by Indian Institute of Technology, Kanpur
2017	Awarded <b>SURGE Fellowship</b> by Indian Institute of Technology, Kanpur
2015	Secured <b>All India Rank - 912</b> in <b>JEE Advanced</b> among 125 thousand candidates
2015	Achieved 99.9 percentile in JEE Mains among 1.5 million candidates
2014	Awarded <b>KVPY Scholarship</b> by Indian Institute of Sciences and Government of India
2013	Achieved <b>International Rank 61</b> (City Topper) in National Science Olympiad

## WORK EXPERIENCE

MAY - JUL 2018	<b>SYSTEM IDENTIFICATION AND CONTROL DESIGN OF 18 WHEELED TRUCK</b> <i>Summer Research Intern at Unmanned Systems Lab, Texas A&amp;M University</i> <i>Supervisor: DR. SRIKANTH SARIPALLI</i> <ul style="list-style-type: none"><li>Designed experiments for longitudinal and lateral control design of a drive-by-wire 18 wheel electric truck retrofitted with PACMod, to achieve Level 2 Automation</li><li>Performed experiments on truck for various speed ranges on straight and curved tracks and collected data using rosbags for input-output modeling</li><li>Created a mathematical model for throttle and steering using System Identification tools</li><li>Obtained a second-order transfer function model for longitudinal dynamics of the truck and validated the results through additional experiments</li><li>Designed a PID controller for longitudinal plant model and verified the results through a Simulink Model of the truck</li><li>Implemented the PID Control(Throttle) and Stanley Control(Steering) and fine-tuned the gains through real-time testing</li></ul> <b>WAYPOINT TWEAKING FOR PATH-FOLLOWING OF AN AUTONOMOUS GOLF-CART</b> <ul style="list-style-type: none"><li>Created a standalone MATLAB application for tweaking the trajectory of waypoints followed by Pure-Pursuit algorithm</li><li>Implemented the application on Level 3 Automated Golf-Cart in campus, to tweak waypoints on Google Map for waypoint path-following</li></ul>
OCT 2017- PRESENT	<b>ALL WHEEL DRIVE, ALL WHEEL STEER ELECTRIC VEHICLE</b> <i>Senior Student Research Associate, IIT Kanpur (DST Funded Project)</i> <i>Supervisor: DR. SHAKTI S. GUPTA (MECHANICAL ENGINEERING) AND DR. RAMPRASAD POTLURI (ELECTRICAL ENGINEERING)</i> <ul style="list-style-type: none"><li>Responsible for designing, manufacturing and testing of a four wheel drive and independent steering electric vehicle</li><li>Designed a CAD model of a Spaceframe Chassis in DS Solidworks and worked on the characterization of spring and dampers through UTM lab testing</li><li>Worked on mathematical modeling of passive suspension for a full car model and performed the optimization of suspension and inertia parameters in MATLAB</li><li>Analyzed the vehicle model in ANSYS APDL for all load conditions including impact, torsion and modal analysis</li><li>Prepared a testing bench for steering and suspension module for evaluating control response, back torque and resolution of steering angle control</li></ul>

MAR 2016- PRESENT	<b>IITK MOTORSPORTS</b> <i>Member, SAE Collegiate Club, IIT Kanpur</i> <i>Supervisor: DR. SANTANU DE, MECHANICAL ENGINEERING</i> <ul style="list-style-type: none"> <li>• Worked on a year long project involving designing and manufacturing of a Formula Student Vehicle</li> <li>• Performed Frame Analysis of Chassis using SolidWorks and Ansys Static Structural</li> <li>• Designed a PVC Chassis for Driver Ergonomics for deciding important parameters</li> <li>• Performed experimental torsional testing of Chassis to validate simulation results obtained from Ansys for torsional stiffness</li> <li>• Designed Jigs and fixtures for suspension subsystem for proper welding operation</li> <li>• Performed Adhesive testing and Quasi-static crush testing of non-standard Impact Attenuator</li> <li>• Assisted in successful conduction of workshop on Automobiles and IC engine in Techkriti'17</li> <li>• Mentored the team to participate in BAJA-SAE India and Shell-Eco Marathon competitions</li> </ul>
MAY - JUL 2017	<b>CHARACTERIZING DELAMINATION OF GLASS FIBER LAMINATES ON IMPACT LOADING</b> <i>SURGE Fellowship, Experimental Stress Analysis Lab, IIT Kanpur</i> <i>Supervisor: DR. P. VENKITANARAYANAN, MECHANICAL ENGINEERING</i> <ul style="list-style-type: none"> <li>• Analyzed glass fiber composites of different thickness and stacking sequence on impact loading using Hopkinson Bar Setup</li> <li>• Used high speed imaging to capture real time images which were then synchronized with the load and load point displacement history</li> <li>• Performed Digital Image Correlation analysis for determining strain and onset of delamination</li> <li>• Simulated composite model for delamination on impact loading using Abaqus software</li> <li>• Obtained the growth of delamination in glass fiber composites by analyzing images in Matlab</li> </ul>

## COURSE PROJECTS

MAR-APR 2019	<b>FORMAL METHODS IN ROBOTICS AND AUTOMATION</b> <i>Formal Methods under Dr. Indranil Saha</i> <ul style="list-style-type: none"> <li>• Generated the optimal path using SAT and SMT based solver for multi robot motion planning with constraints</li> <li>• Implemented motion planner for multi robot using NuSMV model checker</li> <li>• Presented a paper on Sampling Based Motion Planning, a geometry-based, multilayered synergistic approach which involved LTL formula based temporal goals</li> </ul>
AUG-NOV 2018	<b>NONLINEAR FEEDBACK CONTROL FOR AUTONOMOUS VEHICLES</b> <i>Modern Control under Dr. Ramprasad Potluri</i> <ul style="list-style-type: none"> <li>• Implemented the research paper, 'Composite Nonlinear Feedback Control for Path Following of Four-Wheel Independently Actuated Autonomous Ground Vehicles (AGVs)'</li> <li>• Investigated the path-following control problem for AGVs through integrated control of active front-wheel steering and direct yaw-moment control</li> <li>• Applied modified composite non-linear feedback strategy to improve the transient performance and eliminate the steady-state errors in path-following control</li> </ul>
MAR-APR 2018	<b>LANDING OF A VTOL UAV ON A VERTICALLY OSCILLATING PLATFORM</b> <i>Autonomous Navigation under Dr. Mangal Kothari</i> <ul style="list-style-type: none"> <li>• Designed a control structure that could achieve fast, safe and precise landing of a VTOL UAV onto a vertically oscillating landing pad</li> <li>• Implemented motion estimation of the system using Unscented Kalman Filter</li> <li>• Implemented a PID controller to track the generated time-optimal reference trajectory considering all motion constraints</li> </ul>
AUG-NOV 2018	<b>RAIL VEHICLE STABILITY</b> <i>Railroad Vehicle Dynamics under Dr. N.S. Vyas</i>

	<ul style="list-style-type: none"> <li>• Lateral Dynamics - With given track – wheel geometry, contact patch co-ordinates were determined as a function of lateral perturbation by solving the kinematic equations. With geometry as input, equations of motion were solved iteratively on Matlab to get forces at each time step and further estimate critical speed of stability</li> <li>• Longitudinal Dynamics – Observed the response characteristics of the model of a railway coupler by varying source frequency, spring stiffness, draft gear friction and coupler slack</li> <li>• Software Modeling – Developed a model of rail-wheel pair in Simpack, and observed the motion in a straight track, by varying the wheel positions</li> </ul>
AUG-NOV 2018	<b>NONLINEAR CONTROL OF FLEXIBLE MANIPULATORS</b> <i>Vibration of Continuous Systems under Dr. Shakti S. Gupta</i> <ul style="list-style-type: none"> <li>• Designed a strain feedback nonlinear control for joint-PD controlled single-link flexible manipulator to improve tip regulation performance</li> <li>• Solved the modal problem for a beam with tip mass and base moment for first four modes</li> <li>• Simulated the PD controller and nonlinear strain feedback controller for various gains in MATLAB</li> </ul>
MAR-APR 2019	<b>MODAL TESTING AND ANALYSIS SOFTWARE</b> <i>Virtual Instrumentation under Dr. Kamal Poddar</i> <ul style="list-style-type: none"> <li>• Developed a GUI-based software for Modal Testing and Analysis using LabVIEW</li> <li>• Performed frequency analysis and system identification using DAQ and Signal Processing tools</li> </ul>
OCT-NOV 2018	<b>PARALLEL PROGRAMMING USING MPI</b> <i>Finite Element Methods for Fluids under Dr. Sanjay Mittal</i> <ul style="list-style-type: none"> <li>• Implemented a parallel code using Message Passing Interface (MPI) for matrix calculations</li> <li>• Compared the results of various parallel implementation techniques with serial codes</li> </ul>
MAR-APR 2019	<b>PREDICTION OF RUNOUT STABILITY</b> <i>Machining Dynamics under Dr. Mohit Law</i> <ul style="list-style-type: none"> <li>• Implemented the research paper: 'Runout effects in milling: Surface finish, surface location error, and stability'</li> <li>• Studied the effects of runout on surface topography and stability in end milling</li> </ul>

## OTHER PROJECTS

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MAY - JUL AUG 2017	<b>ETHICAL HACKING</b> <i>Sci-Tech Summer Camp, Programming Club</i> <ul style="list-style-type: none"> <li>• Learned about basic control hijacking attacks and assembly language</li> <li>• Presented Wifi traffic Man-in-the-middle attack using Man-in-the-middle framework</li> </ul>
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## POSITIONS OF RESPONSIBILITY

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JUL 2017 - AUG 2018	<b>TECHNICAL HEAD</b> <i>IITK Motorsports</i> <ul style="list-style-type: none"> <li>• Responsible for ensuring proper coordination of all subsystems and their integration</li> <li>• Lead the technical aspects of the team which involved managing timelines, vehicle documentation and maintaining design reports</li> <li>• Managed all technical issues by organizing brainstorming sessions and regular review meetings</li> </ul>
MAY - DEC 2017	<b>CHASSIS SUBSYSTEM LEAD</b> <i>IITK Motorsports</i> <ul style="list-style-type: none"> <li>• Mentored and ensured completion of designing and manufacturing of chassis</li> <li>• Ensured unity in team members and motivated them at difficult times</li> <li>• Initiated the use of non-standard impact attenuator with proper lab testing</li> </ul>
JUL 2017 - AUG 2018	<b>COORDINATOR</b> <i>Association of Mechanical Engineers</i> <ul style="list-style-type: none"> <li>• Designed a website to expose the functionality of the association to the campus community</li> <li>• Responsible for organizing industrial tours/ visits, lab visits, seminars and workshops</li> </ul>

## TEACHING EXPERIENCE

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AUG-Nov 2019	<b>VIBRATION OF CONTINUOUS SYSTEMS</b> <i>Elective Postgraduate Level Course Under Dr. Shakti S. Gupta</i> <ul style="list-style-type: none"><li>Responsible for the design of written and computer-based assignments for the course</li><li>Mentored UG and PG students and reviewed their continuous progress</li></ul>
AUG-Nov 2018	<b>CONTROL SYSTEMS LAB</b> <i>Compulsory Undergraduate Level Course Under Dr. Ramprasad Potluri</i> <ul style="list-style-type: none"><li>Worked as a Teaching Assistant in Controls lab compulsory for the junior undergraduates in the Department of Electrical Engineering</li><li>Performed system identification, control design, tracking control and disturbance rejection problem for a PMDC motor setup prepared completely in the lab itself</li></ul>

## RELEVANT COURSEWORK

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Formal Methods in Robotics	Autonomous Navigation	Machining Dynamics	Modal Analysis
Railroad Vehicle Dynamics	Virtual Instrumentation	Modern Control	Continuous Vibration
Alternative Fuels and Advances in IC Engines	Continuous Vibration	Nonlinear Vibration	Vibration Control
Psychology of Adjustment	Art of Video-Making	Microeconomics	Social Psychology

## TECHNICAL SKILLS

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Programming Languages	Python, C, C++
Tools	NumPy, MATLAB, $\text{\LaTeX}$ , ROS, LabVIEW, Solidworks, Ansys, Abaqus, LaTeX Beamer, Git

## EXTRA CURRICULAR ACTIVITIES

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- Represented IIT Kanpur in National level SAE events, Formula Bharat 2018 and Mega ATV Championship 2019
- Participated in a year-long program for National Cadet Corps at IIT Kanpur
- Exhibited selected photographs in Antaragni'18 Exhibitions and worked in Techkriti'15 coverage team
- Stood first in Design-o-flare competition, Takneek'16, designed a Stirling engine using DS SOLIDWORKS 2016
- Won Derek's Faster Smarter Better Challenge organised by Vodafone at school level
- Participated in State Level Science Exhibition, 2012 conducted by Department of Science and Technology, Rajasthan
- Participated in Badminton Fresher's Inferno'15 and Basketball intramurals in intra-college sports team
- Participated in various Inter-school level quiz competitions organised by Limca Book Awards