

CONTACT INFORMATION

DDD Lab, Mechanical Engineering
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RESEARCH INTERESTS

Shape memory alloy, Mechanics of materials, Machine learning, and Actuators & control

EDUCATION

Indian Institute of Science (IISc), Bengaluru, India

- Doctor of Philosophy (PhD) in Mechanical Engineering (2024 – Ongoing)

Indian Institute of Technology (IIT) Kanpur, Kanpur, India

- Master of Technology (MTech) in Mechanical Engineering (2015 – 2016)
- Bachelor of Technology (BTech) in Mechanical Engineering (2011 – 2015)
(5-years Integrated Dual – Degree Programme)

PUBLICATIONS

Peer-reviewed Journals

- [1] **Chaurasiya, K. L.**, Harsha, A., Sinha, Y., & Bhattacharya, B. (2022). Design and development of non-magnetic hierarchical actuator powered by shape memory alloy based bipennate muscle. *Scientific Reports*, 12(1), 1-15.
- [2] Sampath, S., **Chaurasiya, K. L.**, Aryan, P., & Bhattacharya, B. (2021). An innovative approach towards defect detection and localization in gas pipelines using integrated in-line inspection methods. *Journal of Natural Gas Science and Engineering*, 90, 103933.
- [3] **Chaurasiya, K. L.**, Bhattacharya, B., Varma, A. K., & Rastogi, S. (2020). Dynamic modeling of a cabin pressure control system. Proceedings of Institution of Mechanical Engineers, Part G: *Journal of Aerospace Engineering*, 234, 401-415.

International Conferences

- [1] **Chaurasiya, K. L.**, Gupta, N., Javeed, F., Kumar, V., & Bhattacharya, B. (2024, May). Enhancing actuation frequency of shape memory alloy-based system with a novel evaporative cooling technique for fast cyclic applications. In *Active and Passive Smart Structures and Integrated Systems XVIII* (Vol. 12946, pp. 458-467). SPIE.
- [2] Pandey, A., Haneef, J., Sinha, Y., **Chaurasiya, K. L.**, & Bhattacharya, B. (2024, May). Design and development of a shape memory alloy-powered rotary variable stiffness actuator embedded with an agonist-antagonist mechanism. In *Active and Passive Smart Structures and Integrated Systems XVIII* (Vol. 12946, pp. 468-477). SPIE.
- [3] **Chaurasiya, K. L.**, Pawar, V., & Bhattacharya, B. (2023, April). An innovative method and apparatus for speed control of pipe health monitoring robot during gas pipeline inspection. In *Health Monitoring of Structural and Biological Systems XVII* (Vol. 12488, pp. 372-379) SPIE.
- [4] Sinha, Y., **Chaurasiya, K. L.**, Patel, Y. A. K., Gupta, T., & Bhattacharya, B. (2023, April). Design and development of novel rotary actuation system based on shape memory alloy springs driven mechanism arranged in bipennate muscle architecture. In *Active and Passive Smart Structures and Integrated Systems XVII* (Vol. 12483, pp. 498-510). SPIE.

PATENTS (4 Granted & 2 Pending)

- [1] [Appl. No. 202411043335] (Country: India) “**A Shape Memory Alloy-Based Device with Enhanced Rotational Motion**”, Pub. No. 28/2024, IPC F03G7/06, 2024 (Pending)
- [2] [Patent No. 550600] (Country: India) “**Air-Levitation based Hyperloop Transporting System with Robot Vehicle for Transporting Goods**”, B60L13/04, 2023 (Granted)
- [3] [Appl. No. PCT/US2022/041899] (Countries: United States & European Region) “**Actuator for a Valve**”, Pub. No. WO/2023/034215, IPC F16K 31/02 2006.1, 2022 (Pending)
- [4] [Patent No. 541539] (Country: India) “**Hyperloop Transporting System with Robot Vehicle for Transporting Goods**”, Pub. No. 43/2023, IPC G06Q, 2022 (Granted)
- [5] [Patent No. 414106] (Country: India) “**Bipennate Muscle Architecture-based Shape Memory Alloy Embedded Hierarchical Actuator**”, IPC F03G; B25J, 2021 (Granted)

- [6] [Patent No. 517151] (Country: India) “**Speed Control System for Pipe Health Monitoring Robot**”, Pub. No. 36/2020, IPC H01M; G11B, 2020 (*Granted*)

INVITED
REVIEWER

HONORS AND
AWARDS

- Proceedings of the IMechE, Part E: Journal of Process Mechanical Engineering
- 2022 National **ISSS Technology Award - 2022** for Bio-inspired Muscle Actuator
- 2022 IIT Kanpur Honoured for Coordinator role in 44th & 45th HAL Training Program
- 2017 Tata Motors “**Outstanding**” assessment in annual performance appraisal
- 2016 IIT Kanpur Runner-up for Best M.Tech. Thesis among all engineering disciplines.
- 2014 1st/21 **Best Engineering Summer Project Award**, Whirlpool India
- 2014 Top 21/2500 Whirlpool Young Leaders Program Fellow
- 2013 2nd/200 National level case study competition Manthan by CAG
- 2013 IIT Bombay Certificate of **Engineering Excellence**, Inter-College Robowar Event
- 2012 IIT Kanpur Recipient of Merit-cum-Means Scholarship
- 2012 1st prize Inter-College Combat Robot Tournament, Techkriti, IIT Kanpur
- 2012 IIT Kanpur Certificate of Appreciation for a project in Manufacturing Science
- 2011 National Secured IIT-JEE All India Rank – **1802** (99.62 percentile)
- 2010 National **Merit Certificate** by UP State Govt. for **100/100** in Maths (12th Grade)

PROFESSIONAL
EXPERIENCE
(8 years)

- Indian Institute of Technology (IIT) Kanpur**, Mechanical Engineering, Kanpur, India
Senior Project Scientist (Apr'19- Aug'24)
- Conducting R&D activities leading to translation of research for end-users via industrial partners.
 - Drafting research proposals to various sponsoring agencies and securing a grant of **\$274,700**.
 - Delivering strong project leadership skills via project initiation, planning, & execution phases.
 - Applying and validating analytical & numerical methods to solve dynamic models and applied mechanics problems related to product performance and processes.
 - Led design team and collaborated with research associates and technologists. Identification of failures and improvement in processes based on Design failure mode and effects analysis (DFMEA).
 - Designed & fabricated robot components and performed experiments; gained hands-on experience in additive manufacturing. Prepared and presented reports to cross-functional technical teams.

- Tata Motors Ltd.**, Engineering Research Centre, Pune, India
Senior Manager (Sep'16- Mar'19)
- Performed multibody modeling and vehicle dynamics simulation of Futuristic Infantry Combat Vehicle (FICV) in LMS Virtual.Lab motion solver environment.
 - Analyzed infield failures and resolve issues by designing Interior Trim components across commercial vehicle platforms range. Collaborated with Noise, Vibration & Harshness (NVH) and Engine teams to propose optimal acoustic and thermal packages based on testing & CFD analysis.
 - Prepared and processed DFMEAs, drafted benchmark reports, and ensure all quality standards are met by analyzing and efficiently responding to customer feedback.
 - Formulated product innovation strategies; Co-led team of 12 to implement new technology development projects across multiple vehicle platforms. Strong expertise in managing project gateways, design, estimation, resource allocation, risk management & interfacing with stakeholders.

- Whirlpool of India Ltd.**, Global Technology and Engineering Centre, Pune, India
Summer Intern (May'14- Jun'14)
- Studied Gyroscopic Effect in end spinning of drum-type washing machine and performed dynamic modeling of washer in MATLAB Simulink.
 - Proposed a novel design having an increment in maximum end-spin velocity by 250 RPM leading to a decrease in drying time compared to benchmarked products.

INVITED TALK
& SUMMITS

- [1] *Future of Work: Industry 4.0, Innovation and 21st Century Skills.*, Presented at Y20 Summit - **G20 Youth Consultation Forum** (Apr'23), IIT Kanpur, India.
- [2] *Adaptive Intelligent Pipe Health Monitoring Robot*, Exhibited technology at Uttar Pradesh **Global Investors Summit - National Level** (Feb'23), Lucknow, India.
- [3] *Sustainability Transformation to a Resilient Society*, Invited Speaker at **YNU International Symposium** (Dec'22), Yokohama National University, Japan.

[4] *Adaptive Intelligent Pipe Health Monitoring Robot*, Exhibited among 75 National Projects at **IInvenTiv (23 IITs R&D Fair)** under Ministry of Education, Govt. of India (Oct'22).

RESEARCH PROJECTS

Bio-inspired shape memory alloy-based artificial muscle (*Bipennate*) actuation system
SPONSORED R&D PROJECT | PI: Prof. Bishakh Bhattacharya, IIT Kanpur (Jun'21 - Dec'23)

- Integrated bio-inspired design principles in developing bipennate muscle configured shape memory alloy powered actuators for valve control and prosthetic applications.
- Led a team of 4 to develop and experimentally validate an analytical model for a high-force actuator (257 N with 15 V input). Benchmarked the system against industry-developed actuator, achieved 67% reduction in weight, 32% in cost and 19% energy savings with SMA driven system.

Compressed Air-based Cargo Hyperloop (CABCH) mobility system

PIs: Prof. B. Bhattacharya, Prof. G. Biswas, & Prof. A. K. Varma, IIT Kanpur (Dec'22 - Ongoing)

- Developing a CAD and mathematical model for a pipe-following modular robotic system carrying a series of cargo modules used for transporting powered by the drag force of the compressed-air flow with a designed target velocity of 180 km/hr.

Passive speed control system for Pipeline Health Monitoring Robot (PHMR)

SPONSORED R&D PROJECT | PI: Prof. Bishakh Bhattacharya, IIT Kanpur (Apr'19 - Apr'21)

- Designed, modeled, and experimentally validated the speed control system for an 8-inch pipeline diameter for a PHMR to improve the effectiveness of inspection tool during pipeline pigging.
- Led a team of 15 and tested the system at 3.2 bar pressure and reported to passively regulate any undesirable high-speed spikes maximum by 51% within the acceptable range.

A novel and robust Cabin Pressure Control System (CPCS) for combat aircraft using active smart valve system (Supported by: Hindustan Aeronautics Limited, Lucknow)

MASTER'S THESIS | Advisors: Dr. B. Bhattacharya & Dr. A. K. Varma, IIT Kanpur (Jun'15 - May'16)

- Developed and validated mathematical model for design and performance analysis of pneumatically operated CPCS for multirole light combat aircraft.
- Proposed a piezostack-based active smart valve system for infusing robustness into existing CPCS in terms of reliability, accuracy & easy adaptability to any given cabin pressurization law.
- Created a MATLAB program by incorporating isentropic flow theory through convergent-divergent nozzle and gradient descent algorithm to cover steady-state and transient flight conditions for cabin control volume depicting a standard CPCV architecture as per SAE 2000-ARP 1270.

MENTORING EXPERIENCE

- Mentoring 4 **UG students** as a part of undergraduate projects at IIT Kanpur – projects ranging from Variable stiffness actuator, Bionic arm, SMA rotary system, and Cargo hyperloop system.
- Mentor for **Summer Interns** (2022 & '23), SMSS Lab - IIT Kanpur – delivered tutorials on shape memory alloy models & 3D printing techniques and conducted brainstorming sessions.
- Mentor for two HAL Training Programs (44th & 45th batches - 48 & 28 Trainees), IIT Kanpur – executed interactive sessions on variable-shaped airfoil and origami wing for UAV, provided tutorials on active and passive driving mechanism and reviewed the project deliverable.
- Mentor for **MS by Research & M.Tech.** Students, IIT Kanpur – delivered tutorials on Shape Memory Alloy modeling, interacted with student during doubt-clearing sessions.
- **Teaching Assistant** for Theory of Mechanisms Lab & Smart Material and Structures.

COMPUTER SKILLS

- **Programming Languages:** C, C++, Java, Go, Python
- **Simulation Softwares:** LMS Virtual.Lab, ABAQUS, MATLAB, modeFRONTIER
- **Design Environments:** CATIA V5, SolidWorks, AutoCAD, Inventor
- **Familiar:** MS Office, HPC, PLM, L^AT_EX Origin, Tecplot, LabVIEW, 3D Printing slicing software

RELEVANT COURSES

- Smart Materials & Structures
- Introduction to Robotics
- Data Structures & Algorithms
- Computer Aided Engg. Design
- Vibration & Control
- Finite Element Methods

EXTRA- CURRICULAR ACTIVITIES

- Active member of **Rock Climbing Club** – indoor wall climbing & bouldering sessions.
- Volunteered in **Tata Motors Community Service** Initiatives – educational guidance to tribal children, health awareness camp in rural schools and tree plantation drive.
- Won **first prize** in national level combat robot event held in Techkriti-2012 at IIT Kanpur.