Kanhaiya Lal Chaurasiya

Contact Information

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Research Interests

Shape memory alloy, Actuators and control, Bio-inspired system design, Structural health monitoring, System engineering and New product development (NPD)

Education

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

- M.Tech. in Mechanical Engineering, CPI of 9.0/10 (2016)
- B.Tech. in Mechanical Engineering, CPI of 7.1/10 (2015)
  (5-years Integrated Dual Degree Programme)

St. John's School, CISCE Board, Varanasi, India

- 12^{th} Grade (Intermediate), Scored 90.3%; Secured **100/100** marks in Mathematics (2010)
- 10^{th} Grade (High School), Scored 92.0% (2008)

Publications

Peer-reviewed Journals

[1] **Chaurasiya, K. L.**, Sinha, Y., Bidila, U. K., Killedar, D., Sahu, K. D. & Bhattacharya, B (2023). Design, modelling and experimental validation of bipenniform muscle architecture inspired shape memory alloy-based linear actuator. *Smart Mater. Struct.* (Under revision)

[2] **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. https://doi.org/10.1038/s41598-022-14848-w

[3] 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. https://doi.org/10.1016/j.jngse.2021.103933

[4] **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. https://doi.org/10.1177/0954410019867578

International Conferences

[1] **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.

[2] 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

[1] [Appl. No. 202311068306] (Country: India) "**Air-Levitation based Hyperloop Transporting System with Robot Vehicle for Transporting Goods**", 2023 *(Filed)*

[2] [Patent No. 414106] (Country: India) "**Bipennate Muscle Architecture-based Shape Memory Alloy Embedded Hierarchical Actuator**", IPC F03G; B25J, 2022 *(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 *(Filed)*

[4] [Appl. No. 202211077045] (Country: India) "**Hyperloop Transporting System with Robot Vehicle for Transporting Goods**", Pub. No. 43/2023, IPC G06Q, 2022 *(Filed)*

[5] [Appl. No. 202011016379] (Country: India) "**Speed Control System for Pipe Health Monitoring Robot**", Pub. No. 36/2020, IPC H01M; G11B, 2020 *(Filed)*

Invited Reviewer

- Proceedings of the IMechE, Part E: Journal of Process Mechanical Engineering
- Journal of Smart Materials and Structures

Honors and Awards

2022	National	**ISSS Technology Award - 2022** for Bio-inspired Muscle Actuator
2022	International	Invited Speaker for Yokohama National University - Symposium, Japan
2022	IIT Kanpur	Honoured for Coordinator role in 44^{th} & 45^{th} HAL Training Program
2021	International	Certificate of Participation in International Symposium on Robotics
2021	International	Certificate of Participation in Japanese Sakura Science Exchange 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	1^{st}/21	**Best Engineering Summer Project Award**, Whirlpool India
2014	Top 21/2500	Whirlpool Young Leaders Program Fellow
2013	2^{nd}/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	1^{st} 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)
2011	National	Secured AIEEE All India Rank – **3338** (99.72 percentile)
2010	National	**Merit Certificate** by UP State Govt. for **100/100** in Maths (12^{th} Grade)

Professional Experience *(6.5+ years)*

IIT Kanpur, Smart Materials, Structures and Systems Lab, Mechanical Engg., Kanpur, India

Senior Project Scientist (Apr'19 - Present)

- 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 **$142,500**.
- 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 - Ongoing)

- 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.
- Demonstrated a scaled-down working model showcasing system levitation using air lubrication theory at G20 Youth Consultation Summit (Y20) - *Future of Work: Industry 4.0 & Innovation.*

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, modelled, 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 6 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. Novel system design with dual integration of bypass leakage flow and hydro-mechanical brake mechanisms.

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 (May'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 (44^{th} & 45^{th} 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, LaTeX 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 **IITK Rock Climbing Club** – outdoor wall climbing & bouldering sessions.
- Developed and maintaining website for Smart Materials and Systems Lab, IIT Kanpur.
- 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.
- Finalist at Megapixels–**Photography** Competition, held in Techniche-2012 at IIT Guwahati.