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CONTACT INFORMATION: Department of Hydro and Renewable Energy, I.I.T. Roorkee, Roorkee-247667, India +91-1332-285676

RESEARCH INTERESTS: Hydro-Turbines, Cavitation, Hydro-Kinetic Turbines, Turbulence, Computation Fluid Dynamic (CFD), Erosion, Sedimentation, Mixing, Cloud microphysics, Weather and Climate Predictions, GCMs, Machine Learning, AI

ACADEMIC AND RESEARCH EXPERIENCE

1. Assistant Professor at I.I.T. Roorkee, India — July 2023 to till date
2. Postdoctoral fellow at Lund University, Sweden — August 2022 to July 2023
3. Postdoctoral fellow at Technion-IIT, Israel — July 2019 to July 2022
4. Associate Professor at SRES-SCOE, India — December 2017 to July 2019
5. Assistant Professor at THDC-IHET, India — August 2011 to December 2011

EDUCATION

Indian Institute of Technology Bombay, India

Ph.D., Department of Mechanical Engineering, February 2018

- Thesis Topic: *Large Eddy Simulation of Turbulent Processes Related to Cloud Microphysics*

Indian Institute of Technology Guwahati, India

M.Tech., Department of Mechanical Engineering, May 2011

- Thesis Topic: *Stagnation point injection analysis for drag reduction in hypersonic application*

Kumaon Engineering College-Dwarahat, India

B.E., Department of Mechanical Engineering, July 2009

- *With Honors*

ACADEMIC RESEARCH PROJECTS AND DOCTORAL WORK

Postdoctoral Research: *LES of Tidal Turbines with/without Cavitation* **(July 2019 – July 2022)**

- Lead researcher in an EU Horizon 2020 project focused on cavitation effects in tidal turbines.
- Performed high-fidelity LES and URANS simulations using in-house (MIRACLES) and open-source (OpenFOAM) solvers.
- Investigated hydrodynamic performance and cavitation dynamics under various flow regimes and operating conditions.

Ph.D. Research: *LES of Turbulent Processes Related to Cloud Microphysics* **(Jan 2012 – Oct 2017)**

- Developed LES solvers for non-self-similar free shear flows and turbulent droplet growth during mixing of dry and moist air.
- Modeled condensation in clouds as forced plumes/jets and analyzed the entrainment coefficient—crucial for climate/weather modeling.
- Studied the role of the Damköhler number (ratio of fluid to phase relaxation times) in the evolution of droplet size spectra.

M.Tech Research: *Stagnation Point Injection for Drag Reduction in Hypersonic Flows* **(Apr 2010 – Apr 2011)**

- Performed CFD-based analysis of counterflow injection at the stagnation point in hypersonic flow regimes.
- Demonstrated reductions in aerodynamic drag and thermal loading through stagnation-point flow control strategies.

AWARDS AND RECOGNITIONS

- Secured **3rd Prize** in *Brahmathon 2025* for the project "Smart Hydrokinetic Solutions for Sustainable Energy from the Brahmaputra River," as part of the team with Siddhita Yadav, Pranjali Sharma, and Arun Kumar. Organized by IIT Guwahati, Ministry of Jal Shakti, and Brahmaputra Board, 21-22 March, 2025, IIT Guwahati, India.
- **Best Oral Presentation** in 4^{th} International Conference *Sustainable Multidisciplinary Artificial Intelligence Artificial Intelligence Research For Global Transformations (SMART25*, titled "Machine Learning Approaches for Predicting the Performance of Hydrokinetic Turbines Using Multisource Experimental Data", 21-22 November, 2025, Villa College, Maldives (Online Mode).

Sponsored R&D Projects

No.	Title	Sponsor	Budget (Lakh)	Tenure	Role
1	Harnessing Hydrokinetic Energy: Enhancing Darrieus Turbine Performance with Advanced Techniques (Artificial Neural Network, Numerical and Experimental)	PM-ECRG, ANRF, India	51.97	2025–28	PI
2	Pre-Feasibility Studies of Distributed Hydro Power Generation Using SHKT	NTPC VVNL, India	98.93	2024–25	Co-PI
3	Hydropower Sustainability: Pioneering Health Monitoring for Hydraulic Turbines in the Face of Climate Change	SPARC (MoE), India	102.20	2024–26	PI
4	Passive Flow Strategy to Mitigate Cavitation in a 2D Model of the Guided Vane of Francis Turbine	IIT Roorkee, India	20.00	2024–26	PI
5	Drag Reduction in Turbulent Pipe Flow	Laminera Flow Optimization Ltd., Israel	24.00	2022–23	PI

Consultancy Projects

No.	Title	Sponsor	Budget (Lakh)	Tenure	Role
1	Root Cause Analysis (RCA) For Francis Turbine Runner Damages And Actionable Solution Thereafter	PHPA	49.98	2026–27	PI
2	Performance Guarantee Testing of Shivasamundram HEP (42 MW), Karnataka	Andritz Hydro Pvt. Ltd.	23.60	2026–27	PI
3	Field Efficiency Testing Offer for Sabrigiri Hydro Electric Project (4×55 MW, 2×60 MW), Kerala	Coral Engineering Works	30.00	2026–27	PI
4	Field Efficiency Testing Of Dhakrani HEP (3×11.25 MW), Uttrakhand, India	Flovel Ltd. (FEVL)	16.00	2025–26	PI
5	Due Diligence of Existing SHP Plants: (A) Sonawade (2×2.00 MW), (B) Veer (2×2.40 MW), (C) Gosirkhurd (2×12.00 MW), Maharashtra	Onwards Solar Power Pvt. Ltd., India	20.00	2025–26	PI
6	Field Efficiency Testing Of Rehar HEP(3×8.3 MW), Chhatisgarh, India	Andritz Hydro Pvt. Ltd., India	12.00	2025–26	PI
7	Physical Inspection Of Chanju SHP(3×7.26MW), H.P., India	Regency Yamuna Energy Ltd., India	2.00	2025–26	PI
8	Physical Inspection Of Badyar SHP (4.9 MW), Uttarkhand, India	Cosmos Hydro Ltd. (CHPVL), India	2.00	2025–26	PI
9	Evaluation of Hot Air Generator (HAG) Integration with Existing Waste Heat Recovery (WHR) using Agro Waste as Fuel, India	Shree Cement, India	26.93	2025–26	Co-PI
10	Performance Testing of Vetamamidi MHPP (1×1.2 MW) and Piniarilionda MHPP (1×1.2 MW)	Andhra Pradesh Tribal Power Company Ltd., Vijaywada, India	11.80	2024–25	PI
11	Performance Testing of (a) Bairus SHP (2×750 kW), (b) Chilong SHP (2×500 kW), (c) Matayeen SHP (1×500 kW), Kargil	Kargil Renewable Energy Development Agency (KREDA), India	17.70	2024–25	PI

No.	Title	Sponsor	Budget (Lakh)	Tenure	Role
12	Efficiency Testing of Likhu–A (2×12 MW), Nepal	Andritz Hydro Pvt. Ltd., India	7.50	2024–26	PI
13	Third Party Review for Capacity Enhancement of Raura Hydro Project in Kinnaur, Himachal Pradesh	DLI Power Pvt. Ltd.	2.50	2024–25	PI
14	Thermodynamic Testing of Kisan Ganga Project, India	Voith, NHPC	20.00	2023–24	Co-PI
15	Thermodynamic Testing of Nikachhu Project, Bhutan	Voith	25.00	2023–24	Co-PI

Student Supervision

Ph.D. Students

1. Rahul Kumar Vishwakarma — "Numerical and Experimental Investigation of Erosion in Pelton Turbine," Jan 2024–present.
2. Ravinder Singh — "Investigation of Pressure Transients and Development of Passive Surge Mitigation Modules in Hydraulic Systems," Jan 2024–present.
3. Shivam Bhanu — "Feasibility Study Of Abandoned Coal Mines For Pumped Storage Plants," (Co-Supervisor), July 2024–present.
4. Dan Singh Pimoli — "Integrated Experimental, Computational And Machine Learning-Based Study Of Large Scal Turbulent Fluctuations In Darrieus Hydrokinetic Turbines," Jan 2025–present.
5. Niharika Singh — "Comparison Of Cloud Radiation Feedbacks In Climate Change Among Different Global Models And Improvements To Their Representation," Jan 2025–present.

Masters (M.Tech) Students

1. Rakesh Kaviti — "Experimental and CFD Analysis of an H-Type Darrieus Vertical Axis Hydrokinetic Turbine," 2023–25.
2. Rahul Agrahari — "Performance Analysis of Smooth and Dimpled Blades in Vertical and Horizontal Axis Wind Turbines," 2023–25.
3. Arnav Raj — "Structural Analysis of Vertical Axis Darrieus Hydro-kinetic Turbine using Fluid-Structure Interaction Method," 2024–26.
4. Mridul Dev Jangid — "Comparing Advanced RANS Models to LES and Experiments in Ribbed Passage Heat Transfer Analysis," 2024–26.
5. RajDeep Singhania— "Hydraulic Transient Stability Analysis of a Hydropower Plant using SIMSEN," 2024–26.
6. Ndayisenga Bernard (Co-Supervisor) — "Numerical Investigation on the Cooling of Photovoltaic (PV) Panel Having Phase Change Material (PCM) in Trapezoidal Shape Enclosure," 2024–26.

Refereed Journal Publication

1. Pant, C. S., Waman, D., Patade, S., Deshmukh, A., Singh, N., Phillips, V., and Bansemer, A., 2026, "A modified stratiform cloud microphysics parameterization: evaluation using the Community Atmosphere Model version 6 single-column model", *Atmospheric Chemistry and Physics*, **26** (10), 7407–7433.
2. Mukherjee, A., Khullar, S., Pant, C. S., Kumar, A., and Kumar, A., 2026, "Statistically characterized and experimental validation based guidelines for the use of computational fluid dynamics for the prediction of performance in Francis turbines", *Energy Conversion and Management: X*, 101806.
3. Yadav, S., Kumar, A., and Pant, C.S., 2026, "Selection criteria for hydro kinetic turbines and implications", *Renewable and Sustainable Energy Reviews*, **228**, 116594.
4. Shrivastava, N., Egusquiza, M., Vishwakarma, R., Presas, A., V. David, Pant, C. S. and Rai, A. K., 2025,"Numerical analysis of stress distribution in a Pelton bucket under varying operating parameters", *Engineering Failure Analysis*, **185**, 110379.
5. Vishwakarma, R., and Pant, C. S., 2025, "Field-based characterization and computational assessment of sediment erosion in Pelton turbine injectors at a Himalayan hydropower site", *Physics of Fluids* **37**, 9.

6. Pant, C. S., Bhattacharya, A., and Agrawal, A., 2025, "Characterization of mixing in turbulent jet with off-source heating", *Physica D: Nonlinear Phenomena* **481**, 134759.
7. Jadav, A., Waman, D., Pant, C. S., Patade, S., Martanda, G., Phillips, V., Bansemer, A., Barahona, D., and Storelvmo, T., 2025, "An improved convection parameterization with detailed aerosol-cloud microphysics for a global model", *Journal of the Atmospheric Sciences*, **82**, 197.
8. Gavasane, A., Jha, A., Pant, C. S., Hemadri, V., Bhandarkar, U., and Agrawal, A., 2024, "Investigation of local Nusselt number in a rarefied microchannel gas flow using Direct Simulation Monte Carlo method", *Numerical Heat Transfer, Part A: Applications*, **1–19**.
9. Pant, C. S., Grande, J., and Frankel, S. H., 2024, "Efficient flow reconstruction between dual tidal turbines: Large eddy simulation and reduced order modeling approach", *Physics of Fluids* **36** (4).
10. Pant, C. S., Kishore, P., and Kumar, S., 2022, "Thermal analysis of simultaneously evolving laminar pulsatile flow through two large parallel plates with time-dependent heat flux boundary conditions", *International Journal of Thermal Sciences* **176**, 107529.
11. Kewalramani, G., Pant, C. S., and Bhattacharya, A., 2022, "Energy consistent Gaussian integral model for jet with off-source heating", *Physical Review Fluids* **7** (1).
12. Pant, C. S., Kumar, S., and Gavasane, A., 2021, "Mixing at the interface of the sneezing/coughing phenomena and its effect on viral loading", *Physics of Fluids* **33** (11).
13. Pant, C. S., and Frankel, S., 2021, "Interaction between surface blowing and re-entrant jet in active control of hydrofoil cavitation", *Ocean Engineering* **242**, 110087.
14. Pant, C. S., and Behera, S., 2021, "Effect of humidity on the evolution of COVID-19 droplets distribution in extreme in-homogeneous environment", *Sadhana* **46** (187).
15. Pant, C. S., Delorme, Y., and Frankel, S., 2020, "Accuracy Assessment of RANS Predictions of Active Flow Control for Hydrofoil Cavitation", *Processes* **8** (6).
16. Pant, C. S., and Bhattacharya, A., 2018, "Examining An Energy Consistent One-Dimensional Model for Volumetrically Forced Jets Using Large Eddy Simulations", *Physics of Fluids* **30** (10). **This article was selected as Editor's pick.**
17. Pant, C. S., and Bhattacharya, A., 2016, "A viscous sponge layer formulation for robust large eddy simulation of thermal plumes", *Computers and Fluids* **134**, 177-189.
18. Pant, C. S., and Bhattacharya, A., 2015, "The Effect of Initial Droplet Size Spectra on Its Evolution During Turbulent Condensational Growth", *Procedia IUTAM* **15**, 41-48.

Conferences and Proceedings

1. Mukherjee, A. and Khullar, S., Din, M Z Ud and Pant, C. S. and Kumar, A., 2024, "A comparative analysis of CFD methodologies to predict the performance of Francis turbine", *IOP Conference Series: Earth and Environmental Science-**1477***, IOP Publishing, 012009.
2. Pant, C. S., 2021, "Computational Fluid Dynamics (CFD) for simulating tidal turbine cavitation ", *Ocean Engineering Europe, OEE2021*, December 5-8, Brussels.
3. Pant, C. S., Agrawal A. and Bhattacharya, A., 2018, "Evolution of Droplets During Turbulent Mixing of Air Parcels", *Proceedings of the 7th International and 45th National Conference on Fluid Mechanics and Fluid Power (FMFP)*, December 10-12, IIT-Bombay.
4. Bhattacharya, A. and Pant, C. S., 2017,"Validation of A One Dimensional Model for Volumetrically Forced Jets Using Large Eddy Simulations", *Bulletin of the American Physical Society*, APS.
5. Pant, C. S. and Bhattacharya, A., 2016, "Novel Outflow Boundary Conditions for Large-Eddy Simulation of Pure Thermal Plumes", *iTi Conference on Turbulence VII*, University Centre of Bertinoro, Italy, 7–9 September.
6. Pant, C. S., Bhattacharya, A., and Agrawal, A., 2013, "Condensational growth and spectra of droplets in cumulus clouds", *Proc. of the 22nd National and 11th International ISHMT-ASME Heat and Mass Transfer*, Indian Institute of Technology Kharagpur, India, Paper No. HMTC1300203, 27–30 December.
7. Pant, C.S. and Bhattacharya, A., 2017, "Application of Sponge Boundary Conditions to Large-Eddy Simulation of Multiple Thermal Plumes", *Progress in Turbulence-**VII*** Springer, 239–244.
8. Pant, C.S., Choudry A. and Kulkarni V., 2012, "Counterflow Injection Studies for Hypersonic Flow Fields", *28th International Symposium on Shock Waves*, Springer Berlin Heidelberg, 741–746.

Workshops and Training Programs Conducted

1. Co-coordinator and co-organizer, SPARC workshop on "Workshop on advanced turbine diagnostics: CFD, smart sensors and AI/ML", NIT Warangal, 21-22 December 2026.
2. Co-Coordinator and delivered lectures in "Capacity Building Programme on Hydropower and PSP" on Transient analysis, Computational Fluid Dynamics, and selection of Turbines, Druk Power Corporation Ltd., Bhutan, IIT Roorkee, 16 December 2025 - 05 January 2026.
3. Co-Coordinator and delivered lectures in "Training Course on Pumped Storage Projects," BBMB, IIT Roorkee, 03-07 November 2025.
4. Co-Coordinator and delivered lectures in "Capacity Enhancement Programme on Pumped Storage Hydro Power Generation" on Transient Analysis – input parameters/software/load rejection/load acceptance, Adani Green Energy Limited, India, IIT Roorkee, 25-30 August 2025.
5. Co-Coordinator and delivered lectures in "Workshop on Unlocking the Power of Hydrokinetic Energy," CBIP, Delhi, 6 June 2025.
6. Coordinator and delivered lectures in "Training Course on Solar/Wind Power Technology/Plants from Inception to Commissioning," for NHPC, IIT Roorkee, 7–10 Jan 2025.
7. Coordinator and delivered lectures in "Mitigation Measures for Cavitation and Silt Erosion in Hydro Turbines," for NHPC, 10–12 March 2025.
8. Organizing committee 13^{th} symposium on Hydraulic Machinery and Systems, IAHR (International Association for Hydro-Environment Engineering and Research), 11-14 September 2024.
9. Coordinator and organizer, SPARC workshop on "Futuristic Hydropower Monitoring: Advanced Sensors and AI Tools", IIT Roorkee, 2-6 September 2024.
10. Co-coordinator, "International Workshop on Hydrokinetic Technology," IIT Roorkee, 5–6 July 2024.
11. Organizing committee, Roorkee Water Conclave, IIT Roorkee, 3-6 March 2024

Invited Talks

1. "Understanding turbulence in hydro turbine using CFD", Workshop on advanced turbine diagnostics: CFD, smart sensors and AI/ML, NIT Warangal, 21-22 Jan, 2026.
2. "Hydrokinetic Turbine Technologies and Opportunities", Small hydropower Conclave, Federation of Indian Small Hydropower, Delhi, December, 15, 2025.
3. "CFD Facilities and Its Application in Hydro Turbine Field," Workshop on Turbine Model Testing, Cavitation, Silt Abrasive Erosion, IIT Roorkee, Jan 2024, Jan 2025, & Jan 2026.
4. "Classification of Hydro Turbines and Governing System," Jal Urja Mitra, IIT Roorkee, Aug 2024, March 2025, & Jan 2026 .
5. "Developments in Hydrokinetic Turbines," THDC India Ltd., Rishikesh, Oct 2025.
6. "Computational and Multiphase Challenges in Turbines," CHTC Conference, IIT Hyderabad, June 2024.

Faculty Incharge

Hydraulic Turbine R & D laboratory

Course Taught

Solid and Fluid Mechanics (HRC-201), *Heat and Mass Transfer (HRC-203)*, *Renewable Energy Sources Development Technology (IHR-302)*, *Wind Energy Application Technology (HRC-522)*, *Hydro Mechanical Equipment (HRE-516)*, *Renewable Energy Resources Development Technology (HRC-503)*, *Renewable Energy Resources Development Technology (HRE-513)*

Editorial and Review Activities

Reviewer: *Applied Thermal Engineering*, *Computers and Fluids*,*Environmental Development and Sustainability*, *Environmental Fluid Mechanics*, *Hydrological Processes*, *International Journal of Heat and Mass Transfer*, *Journal of Hydraulic Research*, *Ocean Engineering*, *Physics and Chemistry of the Earth*, *Physics of Fluids*, *Scientific Reports*.

Professional Service

1. Nominated as **Expert Member** in the Ministry of New and Renewable Energy (MNRE) Technical Committees for physical inspection of 8 Small Hydro Power (SHP) projects across India (Jammu and Kashmir, Kerala, Karnataka, Maharashtra). Representing HRED, IIT Roorkee as an External Technical Member (2025).
2. IAHR (International Association for Hydro-Environment Engineering and Research) Member, September 2024 till date.

3. Bureau of Indian Standards (BIS) committee member MED 22.