

Sukanta Chakraborty | PhD

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Research profile

Associate Professor with more than a decade of research and teaching in finite element methods, impact and fracture mechanics, smoothed particle hydrodynamics (SPH), and heterogeneous concrete modelling, supported by sustained sponsored funding, extensive PhD and MTech supervision, and long-standing industry collaborations.

Vision: To build a unified predictive ecosystem that integrates simulation intelligence with architected-material design. Motivated by disaster resilience and smart protection for impact-resilient infrastructure, my group develops physics-first, multiscale computational frameworks that translate directly into safer, more sustainable structures.

Current focus: Integrating SPH, nonlinear FEM, and physics-informed machine learning to predict damage, fracture, and energy dissipation in materials and structures under extreme dynamic loading.

Key research areas

- Computational solid mechanics, nonlinear finite element methods, impact and damage mechanics.
- Mesh-free and particle methods (SPH) for fracture, fragmentation and dynamic failure of materials.
- Data-driven constitutive modelling for heterogeneous concrete and architected composites.
- Surrogate training and uncertainty quantification.

Academic positions

IIT (ISM) Dhanbad, India

Associate Professor

2024–present

Research and teaching in computational mechanics; supervision of PhD and MTech students; led major sponsored projects and curriculum reforms.

IIT (ISM) Dhanbad, India

Assistant Professor

2015–2024

Initiated research in impact and failure of advanced materials; developed new courses for PG students.

Education

PhD in Civil Engineering

Indian Institute of Technology, Kharagpur, India

Thesis: “Mesh-less Framework for Brittle and Ductile Failure Behaviour under Projectile Impact”

MTech in Earthquake Engineering

Indian Institute of Technology, Roorkee, India

Specialization: Structural Dynamics; Recipient of 'Trust Prize — Indian Service of Engineers'.

Research grants

R & D projects

DST–ANRF

Assessing tsunami vulnerability of low-rise structures by SPH modelling, PI Completed

DST–FIST

DST-FIST Level-1 Infrastructure Grant, Co-PI Ongoing

SPARC–MHRD

Nonlinear vibrations and instability analysis of composite structural elements, Co-PI Completed

BPCL

Design Rationalisation of Bridge Support for Railway Siding, Co-PI Completed

DST–SERB

Dynamic Crack Kinking from Aggregate-Mortar Interface of Concrete Sub-Structural System, PI Completed

Total external funding as PI: Rs. 58.44 Lakhs. In addition, an internally funded FRS project and a TEQUIP-III minor project have been completed.

Consultancy projects

As PI: Projects sponsored by: Kalpataru International Ltd., Powergen Technical Services, MECON Ltd., BSEC-SGRL, ECR, ECL and others.

As Co-PI: Projects sponsored by: CPWD, Ircon International, NHAI, Auro-Infra, NBCC, Wapcos, AECOM, and others.

Cumulative consultancy value: Rs. 479 Lakhs. Services span structural assessment, design review/vetting, and impact/failure evaluation for infrastructure clients across India.

Alignment with UN Sustainable Development Goals

SDG 9: Industry, Innovation and Infrastructure — Targets 9.1 (resilient infrastructure) and 9.5 (upgrade research capacity). Evidence: FEM/SPH structural analysis and bridge design; impact-resilient infrastructure research; DST-SERB, DST-ANRF and SPARC-MHRD funded R&D.

Selected journal articles

2026: Sharma M. K. and **Chakraborty S.**, “Dynamic failure and energy dissipation in scalable sandwich structures with bistable auxetic topologies,” *Composite Structures*, 383, 120141, 2026. [IF: 6.3]

2026: Bharadwaj A., Sharma M. K., **Chakraborty S.** and Biswas D., “Uncertainty-driven damage estimation of concrete: Integrating realistic aggregate morphology and stochastic flaw behaviour,” *International Journal of Solids and Structures*, 326, 113775, 2026. [IF: 3.9]

2025: Sharma M. K., Bharadwaj A. and **Chakraborty S.**, “A novel hybrid bistable auxetic metamaterials with reusable geometric configuration for energy dissipation,” *International Journal of Structural Integrity*, 16(5), pp. 1138–1157, 2025. [IF: 3.0]

2024: Sarkar S., **Chakraborty S.** and Nayak S., “ANN-based axial strength prediction of short

columns with double and bar-reinforced concrete-filled steel tubes subjected to concentric and eccentric loading," *Arabian Journal for Science and Engineering*, 49(4), pp. 4947–4968, 2024. [IF: 2.9]

2023: Sarkar S., **Chakraborty S.** and Nayak S., "Identification of optimum reinforcement detailing using tuned CDP parameters in RC beam under drop-weight impact," *Engineering Failure Analysis*, 146, 107116, 2023. [IF: 4.4]

2023: Khan D. and **Chakraborty S.**, "Axisymmetric model for Taylor impact test and estimation of metal plasticity using nonlinear deformation profile," *Journal of the Brazilian Society of Mechanical Sciences and Engineering*, 45(3), 128, 2023. [IF: 2.1]

2022: Bharadwaj A. and **Chakraborty S.**, "Numerical investigation on effect of randomized mesoscopic heterogeneity in stochastically located arbitrary shaped aggregates in impact response of reinforced concrete," *Engineering Failure Analysis*, 141, 106691, 2022. [IF: 4.4]

2022: Sahu A., **Chakraborty S.** and Dey T., "Performance evaluation of sustainable recycled aggregate concrete with colloidal nano-silica," *European Journal of Environmental and Civil Engineering*, 26(15), pp. 7878–7898, 2022. [IF: 2.3]

2021: Sahu A., Dey T. and **Chakraborty S.**, "Influence of nano silica on mechanical and durability characteristic of mortar made by partial replacement with recycled fine aggregate," *Silicon*, 13, pp. 4391–4405, 2021. [IF: 3.3]

2018: Islam M. R. I., **Chakraborty S.** and Shaw A., "On Consistency and Energy Conservation in Smoothed Particle Hydrodynamics," *International Journal for Numerical Methods in Engineering*, 116(9), pp. 601–632, 2018. [IF: 2.9]

2017: Islam M. R. I., **Chakraborty S.**, Shaw A. and Reid S., "A computational model for failure of ductile material under impact," *International Journal of Impact Engineering*, 108, pp. 334–347, 2017. [IF: 5.1]

2017: **Chakraborty S.**, Islam M. R. I., Shaw A., Ramachandra L. S. and Reid S. R., "A computational framework for modelling impact induced damage in ceramic and ceramic-metal composite structures," *Composite Structures*, 164, pp. 263–276, 2017. [IF: 6.3]

2015: **Chakraborty S.** and Shaw A., "Prognosis for Ballistic Sensitivity of Pre-Notch in Metallic Beam through Mesh-less Computation Reflecting Material Damage," *International Journal of Solids and Structures*, 67–68, pp. 192–204, 2015. [IF: 3.9]

2015: **Chakraborty S.**, Shaw A. and Banerjee B., "An axisymmetric model for Taylor impact test and estimation of metal plasticity," *Proceedings of the Royal Society A*, 471, 2015, doi: 10.1098/rspa.2014.0556. [IF: 3.5]

2015: Shaw A., Reid S. R., Roy D. and **Chakraborty S.**, "Beyond classical dynamic structural plasticity using mesh-free modelling techniques," *International Journal of Impact Engineering*, 75, pp. 268–278, 2015. [IF: 5.1]

2014: **Chakraborty S.** and Shaw A., "Crack Propagation in Bi-material System via Pseudo-Spring Smoothed Particle Hydrodynamics," *International Journal for Computational Methods in Engineering Science and Mechanics*, 15(3), 2014, pp. 294–301. [IF: 1.2]

2013: **Chakraborty S.** and Shaw A., "A pseudo-spring based fracture model for SPH simulation of impact dynamics," *International Journal of Impact Engineering*, 58, pp. 84–95, 2013. [IF: 5.1]

Conference Publications and Presentations

2025: Das D. K. and **Chakraborty S.**, "Damage analysis due to debris impact on cylindrical RCC col-

umn," 14th International Symposium on Plasticity and Impact Mechanics (IMPLAST 2025), Roorkee, India.

2025: Danish D. A. and **Chakraborty S.**, "Behaviour of concrete-filled steel tube beams and columns," International Conference on Smart, Resilient and Sustainable Infrastructure (SRISTI), Dhanbad, India, 24–25 January 2025.

2025: Raj R. and **Chakraborty S.**, "Data-based health monitoring of wind turbine blade using machine learning algorithm," International Conference on Smart, Resilient and Sustainable Infrastructure (SRISTI), Dhanbad, India, 24–25 January 2025.

2022: Sharma P., Sarkar S., **Chakraborty S.** and Nayak S., "Effect of Rebar Arrangement and Support Condition on Impact Response of RC Slab," 13th International Symposium on Plasticity and Impact Mechanics (IMPLAST 2022), Madras, India, 21–26 August 2022.

2020: Bharadwaj A. and **Chakraborty S.**, "A numerical approach to model heterogeneity of concrete in RC beam subjected to impact loading," 1st Online International Conference on Recent Advances in Computational and Experimental Mechanics (ICRACEM 2020), Kharagpur, India, 4–6 September 2020.

2019: Sarkar S., Lama A., **Chakraborty S.** and Nayak S., "Effect of Drop Weight and Drop Height on Impact Behaviour of Reinforced Concrete Beam," 7th International Congress on Computational Mechanics and Simulation (ICCMS 2019), Mandi, India, 11–13 December 2019.

2019: Jain V., Kumar R. and **Chakraborty S.**, "Non-linear Dynamic Response and Dynamic Buckling of Isotropic Imperfect Thin Plates," International Conference on Nonlinear Solid Mechanics (ICoNSoM 2019), Rome, Italy, 20–23 June 2019.

2017: **Chakraborty S.** and Dey T., "Mesh-less simulation of crack propagation in Functionally Graded Materials (FGM) subjected to impact loading," 20th International Conference on Composite Structures (ICCS 20), Paris, France, 4–7 September 2017.

2017: Dey T. and **Chakraborty S.**, "Dynamic instability analysis of FGM cylindrical shell panels subjected to parabolic edge loading and thermal environment," 20th International Conference on Composite Structures (ICCS 20), Paris, France, 4–7 September 2017.

2016: Sahu A., Dey T. and **Chakraborty S.**, "Study on the Interfacial Transition Zones of recycled aggregate concrete," 2nd International Conference on Sustainable Energy and Built Environment (ASCE-ICES), Vellore, India, 10–12 March 2016.

2014: Rusdie M. I., **Chakraborty S.** and Shaw A., "Evaluation of metal plasticity by optimization on mathematical model of Taylor impact test," Structural Engineering Convention (SEC), IIT Delhi, India, 22–24 December 2014.

2014: Rusdie M. I., **Chakraborty S.** and Shaw A., "Numerical simulation of adiabatic shear plugging," 5th International Congress on Computational Mechanics and Simulation (ICCMS), Chennai, India, 10–13 December 2014.

2014: **Chakraborty S.** and Shaw A., "Numerical Modelling of Dynamic Crack Growth past an Inclusion," International Conference on Computational & Experimental Engineering and Sciences (ICCES 2014), Changwon, Korea, 12–17 June 2014.

2012: **Chakraborty S.** and Shaw A., "Damage in Brittle Solids via Pseudo-Spring Smoothed Particle Hydrodynamics," 4th International Congress on Computational Mechanics and Simulation (ICCMS), IIT Hyderabad, India, 10–12 December 2012.

2010: **Chakraborty S.**, Mondal S. B., Guchhait S. and Pandey A. D., "Influence of Train Speed on Fatigue characteristics of a Steel Girder Railway Bridge," 14th Symposium on Earthquake Engineering (SEE), IIT Roorkee, India, 17–19 December 2010.

2010: Chakraborty S. and Pandey A. D., "Soil-Structure interaction effects on fatigue life of a long span Railway steel truss bridge," 14th Symposium on Earthquake Engineering (SEE), IIT Roorkee, India, 17–19 December 2010.

Book chapters and related contributions

2022: Bharadwaj A. and **Chakraborty S.**, "A Numerical Approach to Model Heterogeneity of Concrete in RC Beam Subjected to Impact Loading," in *Lecture Notes in Mechanical Engineering*, Vol. II, 2022, pp. 473–485.

2016: Sahu A., Dey T. and **Chakraborty S.**, "Study on the Interfacial Transition Zones of Recycled Aggregate Concrete," *Indian Journal of Science and Technology*, 9(47), 2016, pp. 1–6.

Teaching experience

Courses taught (UG and PG at IIT (ISM) Dhanbad, 2015–present).....

Finite Element Method	Structural Analysis
Elasticity and Plasticity	Solid Mechanics
Theory of Plates and Shells	CAD for Civil Engineering
Advanced Design of Structures	Engineering Graphics
Structural Analysis Laboratory	

Courses redesigned.....

Structural Analysis, Finite Element Method, Theory of Plates and Shells.

Laboratory and infrastructure development.....

Departmental Computational Laboratory; Drop-weight impact test set-up.

Research Supervision

Ph.D. Supervision.....

Dr. M. Sharma **2025**

Currently employed at IIT Kanpur

"Hybrid Reentrant Metamaterials with Snap-Through Mechanisms: Design, Energy Dissipation, and Impact Performance."

Dr. A. Bharadwaj **2023**

Currently Faculty, Assam Skill University

"A numerical framework for damage assessment of RC structures considering three-phase mesoscopic heterogeneity under quasi-static and impact loading."

Dr. S. Sarkar **2023**

Currently Faculty, SMIT, Jointly Supervised with Dr. S. Nayak

"Low-velocity impact performance of concrete and composite sub-structural members using ANN-based applications with optimally generated FEA data."

Dr. A. Sahu **2022**

Currently employed in industry, Jointly Supervised with Dr. T. Dey

"Sustainable development of concrete using recycled coarse and fine aggregates."

Current Ph.D. Scholars.....

2024–: Mr. Dabeer Answer Danish — Modal-energy mechanism of functionally graded material

(FGM) plates

2023–: Mr. Deepak Kumar Das — Simultaneous wave-debris impact on concrete structures

2023–: Mr. Rohit Raj — Seismic and wind response of wind turbine systems

2022–: Mr. Mujahid Alam — SPH modelling of HRAM event

M.Tech. Supervision.....

Completed: Supervised 19 projects in computational mechanics, including impact-resilient smart protection, material damage simulation and data-driven surrogates.

Ongoing: 3

Professional service

Editorial: Associate Editor, *ISET Journal of Earthquake Technology* (ISSN 0971-9555).

Reviewing: For *International Journal of Impact Engineering*, *Composite Structures*, *Engineering Failure Analysis*, *International Journal of Fracture*, *International Journal of Solids and Structures*, *Computers and Structures*.

Member: Committee of DHTE, Jharkhand

Member: Centre for Blasting Technology and Research

Memberships and outreach

Memberships.....

Member, American Society of Civil Engineers (ASCE).

Life Member, Indian Society of Earthquake Technology (ISET).

Member, Institution of Engineers (India).

Outreach talks and workshops for academic and industrial audiences.....

“Impact Damage Assessment of RC Beam” — ETNESTSE 2025, NIT Rourkela, January 2025.

“Performance of Concrete in Aggressive Environment” — Dalmia Cements-sponsored course, IIT (ISM) Dhanbad, February 2019.

“Fatigue Characteristics of Steel Railway Truss Bridges” — ASGE, IIT (ISM) Dhanbad, June 2018.

“Concrete in Aggressive Environment” — ACE (DST-sponsored), IIT (ISM) Dhanbad, April 2018.

“Influence of SSI on Fatigue Characteristics of Steel Railway Truss Bridges” — UGC Refresher Course, Jadavpur University, January 2018.

Workshop on “Design of Experiments and Statistical Modelling” - organised by SQC and OR unit of Indian Statistical Institute Hyderabad and NIT Sikkim, March 2015.

Workshop on “National Seminar on Housing and Disaster Mitigation in India: Case Studies (HDME-09)” - organised by Centre of Excellence in Disaster Mitigation and Management, IIT Roorkee, April 2009 at IIT Roorkee.

Conferences: Scientific/organising committee member at national and international conferences on computational mechanics and impact engineering.

Administrative responsibilities

Member, DFSC

Mar 2025–present

<i>FIC, Concrete Laboratory</i>	<i>Aug 2025–present</i>
<i>Member, Departmental Post-Graduate Committee (DPGC)</i>	<i>Oct 2024–present</i>
<i>Convener, Departmental Under-Graduate Committee (DUGC)</i>	<i>Oct 2022–Oct 2024</i>
<i>VP (Faculty), Civil Engineering Society</i>	<i>Sep 2019–Oct 2022</i>
<i>FIC, Departmental Computational Facility</i>	<i>Nov 2016–Sep 2019</i>

Last updated: Apr 2026.