Subhankar Sen
Associate Professor, Department of Mechanical Engineering, Indian Institute of Technology (Indian School of Mines) Dhanbad

Academic qualifications:

Exams/Degree	Year	Stream/Specialization	Board/University/Institute	% of marks/CPI
Ph.D.	2010	Fluid and Thermal Sciences (Mechanical Engineering)	IIT Kanpur	CPI 8.50
M.Tech.	2003	Fluid and Thermal Sciences (Mechanical Engineering)	IIT Guwahati	CPI 8.86
B.E.	1999	Mechanical Engineering	Jadavpur University	72.12%
Higher Secondary (10+2)	1993	Pure Science	West Bengal Council of Higher Secondary Education (Jalpaiguri Zilla School)	76.60%
Madhyamik (10th)	1991	–	West Bengal Board of Secondary Education (Jalpaiguri Zilla School)	80.11%, 96^{th} state level rank in West Bengal

WBJEE (1995) rank in Engineering: 278

GATE (2001) percentile in Mechanical Engineering: 95.15, **All India rank**: 430

Research experience: Post-Doctoral Research Fellow in the Department of Mechanical Engineering at National University of Singapore from April 2013 to July 2014.

Industrial experience: Served at Datre Corporation Limited, West Bengal as a Graduate Engineer Trainee from June 1999 to August 2000.

Areas of interest: Computational Fluid Dynamics, Finite Element in fluids, Bluff body aerodynamics, Separated flows, Fluid-Structure interactions.

Publications:

In refereed international journals:

31. Pavan Kumar Yadav, Himalaya Sarkar and Subhankar Sen. Flow past a freely vibrating elliptic cylinder at 45° incidence. Published online in *Journal of Fluids and Structures*, 2024, vol. 130, 104201.
30. Shravan Kumar Mishra and Subhankar Sen. Flow past two diamond-section cylinders in tandem arrangement at a low Reynolds number. *Physics of Fluids*, 2024, vol. 36(7), 073614.
29. Deepak Kumar, Kumar Sourav and Subhankar Sen. Exploring kinematic stability of vortex structures: a topological approach to fluid flow around staggered square cylinders. *Physics of Fluids*, 2024, vol. 36(7), 073605.
28. Shravan Kumar Mishra and Subhankar Sen. On the critical spacing between two in-line diamond cylinders at $Re = 100$. *Ocean Engineering*, 2024, vol. 296, 117011.
27. Pavan Kumar Yadav and Subhankar Sen. Predicting the upper bound of two-dimensional flow regimes of symmetric objects through two-dimensional computations. *Physics of Fluids*, 2024, vol. 36(2), 023609.
26. Pavan Kumar Yadav, Sachin Sharma and Subhankar Sen. Damped flow-induced vibrations

of a square cylinder at low Reynolds numbers. *Journal of Flow Visualization and Image Processing*, 2023, vol. 30(1), pp. 87-113.

25. Shravan Kumar Mishra, Pavan Kumar Yadav, Himalaya Sarkar and Subhankar Sen. Correspondence between the number of no-slip critical points and nature of rear stagnation point of a symmetric object. *Physics of Fluids*, 2022, vol. 34(11), 111702.

24. Subhankar Sen. Wake modes of a freely vibrating square cylinder. *Physics of Fluids*, 2022, vol. 34(5), 053601.

23. Pavan Kumar Yadav, Kumar Sourav, Deepak Kumar and Subhankar Sen. Flow around a diamond-section cylinder at low Reynolds numbers. *Physics of Fluids*, 2021, vol. 33(5), 053611.

22. Deepak Kumar and Subhankar Sen. Flow-induced vibrations of a pair of in-line square cylinders. *Physics of Fluids*, 2021, vol. 33(4), 043602.

21. Shravan Kumar Mishra, Subhankar Sen and Akhil Verma. Steady flow past a circular cylinder under large blockage. *European Journal of Mechanics B/Fluids*, 2021, vol. 87, pp. 135–150.

20. Subhankar Sen. Surface pressure and viscous forces on inclined elliptic cylinders in steady flow. *Sadhana*, 2020, vol. 45, 172.

19. Kumar Sourav and Subhankar Sen. Determination of the transition mass ratio for onset of galloping of a square cylinder at the least permissible Reynolds number of 150. *Physics of Fluids*, 2020, vol. 32(6), 063601:1-19.

18. Kumar Sourav, Deepak Kumar and Subhankar Sen. Vortex-induced vibrations of an elliptic cylinder of low mass ratio: identification of new response branches. *Physics of Fluids*, 2020, vol. 32(2), 023605:1-20.

17. Kumar Sourav, Deepak Kumar and Subhankar Sen. Undamped transverse-only VIV of a diamond cylinder at low Reynolds numbers. *Ocean Engineering*, 2020, vol. 197, 106867.

16. Deepak Kumar, Kumar Sourav and Subhankar Sen. Steady separated flow around a pair of identical square cylinders in tandem array at low Reynolds numbers. *Computers and Fluids*, 2019, vol. 191.

15. Kumar Sourav and Subhankar Sen. Transition of VIV-only motion of a square cylinder to combined VIV and galloping at low Reynolds numbers. *Ocean Engineering*, 2019, vol. 187, 106208.

14. Deepak Kumar, Kumar Sourav, Pavan Kumar Yadav and Subhankar Sen. Understanding the secondary separation from an inclined square cylinder with sharp and rounded trailing edges. *Physics of Fluids*, 2019, vol. 31(7), 073607:1-16.

13. Deepak Kumar, Amit Kumar Singh and Subhankar Sen. Identification of response branches for oscillators with curved and straight contours executing VIV. *Ocean Engineering*, 2018, vol. 164, pp. 616-627.

12. Deepak Kumar, Kumar Sourav, Subhankar Sen and Pavan Kumar Yadav. Steady separation of flow from an inclined square cylinder with sharp and rounded base. *Computers and Fluids*, 2018, vol. 171, pp. 29-40.

11. Deepak Kumar, Manik Mittal and Subhankar Sen. Modification of response and suppression of vortex-shedding in Vortex-Induced Vibrations of an elliptic cylinder. *International Journal of Heat and Fluid Flow*, 2018, vol. 71, pp. 406-419.

10. Subhankar Sen and Sanjay Mittal. A study on the far wake of elliptic cylinders. *Computer Modeling in Engineering and Sciences*, 2017, vol. 113, pp. 33-53.

9. Kumar Sourav and Subhankar Sen. On the response of a freely vibrating thick elliptic cylinder of low mass ratio. *Journal of Applied Fluid Mechanics*, 2017, vol. 10(3), pp. 899-913.

8. Subhankar Sen and Sanjay Mittal. Free vibrations of a square cylinder of varying mass ratios. *Procedia Engineering*, 2016, vol. 144, pp. 34-42.

7. Rajeev Kumar Jaiman, Subhankar Sen and Pardha Sarathi Gurugubelli. A fully implicit combined field scheme for freely vibrating square cylinders with sharp and rounded corners.

Computers and Fluids, 2015, vol. 112, pp. 1-18.
6. Subhankar Sen and Sanjay Mittal. Effect of mass ratio on free vibrations of a square cylinder at low Reynolds numbers. *Journal of Fluids and Structures*, 2015, vol. 54, pp. 661-678.
5. Navrose, V. Yogeswaran, Subhankar Sen and Sanjay Mittal. Free vibrations of elliptic cylinders at low Reynolds numbers. *Journal of Fluids and Structures*, 2014, vol. 51, pp. 55-67.
4. Subhankar Sen, Sanjay Mittal and Gautam Biswas. Steady separated flow past elliptic cylinders using a stabilized finite-element method. *Computer Modeling in Engineering and Sciences*, 2012, vol. 86, pp. 1-28.
3. Subhankar Sen and Sanjay Mittal. Free vibration of a square cylinder at low Reynolds numbers. *Journal of Fluids and Structures*, 2011, vol. 27, pp. 875-884.
2. Subhankar Sen, Sanjay Mittal and Gautam Biswas. Flow past a square cylinder at low Reynolds numbers. *International Journal for Numerical Methods in Fluids*, 2011, vol. 67, pp. 1160-1174.
1. Subhankar Sen, Sanjay Mittal and Gautam Biswas. Steady separated flow past a circular cylinder at low Reynolds numbers. *Journal of Fluid Mechanics*, 2009, vol. 620, pp. 89-119.

Conference papers published as book chapters:

4. Pavan Kumar Yadav and Subhankar Sen. Effect of mass ratio on the response of an upstream truncated circular cylinder. In *Proceedings of the 26th National and 4th International ISHMT-ASTFE Heat and Mass Transfer Conference, IIT Madras*, Begel House, 2021, pp. 53-57.
3. Subhankar Sen. Transverse-only vibrations of a rigid square cylinder. In *Recent Advances in Theoretical, Applied, Computational and Experimental Mechanics*, Springer, 2020, pp. 397-406.
2. Deepak kumar, Kumar Sourav, Subhankar Sen. Steady flow past two square cylinders in tandem. In *Recent Advances in Theoretical, Applied, Computational and Experimental Mechanics*, Springer, 2020, pp. 407-414.
1. Shravan Kumar Mishra, Deepak Kumar, Kumar Sourav, Pavan Kumar Yadav and Subhankar Sen. Highly confined flow past a stationary square cylinder. In *Advances in Fluid and Thermal Engineering*, Springer, 2019, pp. 127-135.

In refereed international conferences:

9. Pavan Kumar Yadav, Himalaya Sarkar and Subhankar Sen. Flow-induced vibrations of an inclined elliptic cylinder. In *Proceedings of the 2nd International Conference on Mechanical Engineering*, Jadavpur University, Kolkata, India, January 5-6, 2024. Paper No. 124.
8. Subhankar Sen, Kumar Sourav and Deepak Kumar. Identification of a new wake mode for transverse vortex-induced vibrations of a square cylinder at low Reynolds number. In *Proceedings of the 7th International and 45th National Conference on Fluid Mechanics and Fluid Power*, IIT Bombay, Mumbai, India, December 10-12, 2018. Paper No. 91.
7. Subhankar Sen. Transverse-only vibrations of a rigid square cylinder. In *Proceedings of the 7th International Conference on Theoretical, Applied, Computational and Experimental Mechanics*, IIT Kharagpur, India, 28-30th December, 2017. Paper No. 335.
6. Subhankar Sen and Sanjay Mittal. Free vibrations of a square cylinder of varying mass ratios. *12th International Conference on Vibration Problems*, IIT Guwahati, India, 14-17th December, 2015. Paper No. ICOVP-O0015.
5. Subhankar Sen, Sanjay Mittal and Gautam Biswas. Far wake of an elliptic cylinder. In *Proceedings of the 5th International Conference on Theoretical, Applied, Computational and Experimental Mechanics*, IIT Kharagpur, India, 27-29th December, 2010. Paper No. 147.
4. Subhankar Sen, Sanjay Mittal and Gautam Biswas. Effects of cross-section on steady

flow past cylinders. In *Proceedings of the 13th Asian Congress of Fluid Mechanics*, Dhaka, Bangladesh, 17-21st December, 2010. Paper No. 292.
3. Subhankar Sen, Sanjay Mittal and Gautam Biswas. Numerical simulation of steady flow past a circular cylinder. In *Proceedings of the 37th National and 4th International conference on Fluid Mechanics and Fluid Power*, IIT Madras, Chennai, India, 16-18th December, 2010. Paper No. 189.
2. Subhankar Sen, Sanjay Mittal and Gautam Biswas. Free vibration of cylinders of various cross-sections. In *Proceedings of IUTAM Symposium on Bluff Body Wakes and Vortex-Induced Vibrations (BBVIV-6)*, pp. 325-328, Capri Island, Italy, 22-25th June, 2010.
1. Subhankar Sen, Sanjay Mittal and Gautam Biswas. Finite-element simulation of steady flow past elliptic cylinders. In *Proceedings of the 8th Asian Computational Fluid Dynamics Conference*, Hong Kong, 10-14th January, 2010. Paper No. ACFD0035-T007-A-001.

Title of M.Tech. thesis (Department of Mechanical Engineering, IIT Guwahati): *Steady, laminar, incompressible flow in a cubic lid-driven cavity.*

Title of Ph.D. thesis (Department of Mechanical Engineering, IIT Kanpur): *Flow past stationary and vibrating cylinders of various cross-sections at low Reynolds numbers.*

M.Tech. thesis supervision:

Completed:

(1) Kumari Menaka Attmaja Ray, Mechanical Engineering Department, 'Flow past an elliptic cylinder', July 2012 - June 2013.
(2) Sachin Sharma, Mechanical Engineering Department, ISM Dhanbad, 'Damped free vibrations of a square cylinder', July 2015 - April 2016.
(3) Ramesh Kumar Biswakarma, Mechanical Engineering Department, ISM Dhanbad, 'Free transverse-only vibrations of a square cylinder', July 2015 - April 2016.
(4) Dheeraj Kumar Das, Mechanical Engineering Department, ISM Dhanbad, 'Flow past a circular cylinder with and without rotation', July 2015 - April 2016.
(5) Lukesh Kumar Mahato, Mechanical Engineering Department, ISM Dhanbad, 'Recirculating flow in straight and curved cavities', July 2015 - April 2016.
(6) Pavan Kumar Yadav, Mechanical Engineering Department, ISM Dhanbad, 'Flow past an inclined square cylinder', July 2015 - April 2016.
(7) Amit Kumar Singh, Mechanical Engineering Department, ISM Dhanbad, 'Flow around elliptic and truncated circular cylinders', July 2015 - April 2016.
(8) Akhil Verma
(9) Ishan
(10) Manik Mittal
(11) Sachin Sourav
(12) Shravan Mishra
(13) Rajosik Adak
(14) Pritam Kumar
(15) Jit Sinha
(16) Sanjeet Kumar
(17) Shreedhara Goswami
(18) Manas Kumar Naskar
(19) Surajit Bit
(20) Santanu Nath

(21) Subarna Mukherjee
(22) Harshawardhan More
(23) Aman Kumar
(24) Ujjwal Mohanty
(25) Ranajit Majumdar
(26) Ashish Dangi
(27) Manish D Pipal
(28) Tushar Kumar Gupta
(29) Rahul Raj
(30) Aman Vardhan Verma

Ongoing:

(1) Priyanshu Ranjan Arya

Ph.D. thesis supervision:

Completed:

(1) Kumar Sourav, Thesis title: Free vibrations of square and elliptic cylinders at low Reynolds numbers (September, 2020)
(2) Deepak Kumar, Thesis title: Flow around stationary and freely vibrating single and pair of in-line cylinders (February, 2021)
(3) Pavan Kumar Yadav, Thesis title: Flow past bluff bodies without and with motion (December, 2023)
(4) Shravan Kumar Mishra, Thesis title: Laminar external flow around single and twin in-line objects (July, 2024)

Ongoing:

(1) Himalaya Sarkar

Institute post-Doctoral fellow:

(1) Dr. Bishwajit Sharma

Summer Intern:

(1) Mr. Debanshu Banerjee, BIT Mesra, May 2024 - June 2024

Course developed:

1. Finite Element Method in Thermal Engineering

Courses taught:

1. Finite Element Method (PG and Ph.D.)
2. Finite Element Method in Thermal Engineering (UG, PG and Ph.D.)
3. Computational Fluid Dynamics (UG, PG and Ph.D.)
4. Advanced Fluid Mechanics (UG)

5. Incompressible and Compressible Flow (PG and Ph.D.)
6. Refrigeration and Air-conditioning (PG and Ph.D.)
7. Heat Exchanger Design (PG and Ph.D.)
8. Engineering Mechanics (UG)
9. Mechanical Engineering I (UG)
10. Mechanical Engineering II (UG)

Sponsored projects:

1. DST SERB MATRICS 2022
2. DST SERB CRG 2023

Evaluation of Masters (M.Tech. by researh) thesis:

1. Department of Chemical Engineering, NIT Rourkela, August 2018 (examined the thesis and conducted offline viva voce examination).

Evaluation of M.Phil. thesis:

1. School of Mechanical and Manufacturing Engineering, University of New South Wales, Sydney, Australia, August 2024 (examined the thesis).

Evaluation of Doctoral theses:

1. Department of Mechanical Engineering, BITS Pilani Hyderabad, September 2022 (examined the thesis and conducted offline viva voce examination).
2. Department of Aerospace Engineering, IIT Madras, April 2024 (examined the thesis).
3. Department of Mechanical Engineering, IIT Bombay, May 2024 (examined the thesis).

Awards/Scholarships:

1. National Scholarship for securing a state level rank of 96^{th} in the Madhyamik (10^{th}) examination 1991.
2. Award from Dooars Branch Indian Tea Association for securing 8^{th} rank in Jalpaiguri district in the Higher Secondary examination 1993.
3. Award from West Bengal Government School Teachers Association for securing 1^{st} rank among students from Jalpaiguri Zilla School in the Higher Secondary examination 1993.
4. Institute scholarship during M.Tech. (from IIT Guwahati) and Ph.D. (from IIT Kanpur).
5. Award from IIT Kanpur for publication of research work in international journals.
6. Post-doctoral fellowship at National University of Singapore.

Best paper award:

Akhil Verma and Shravan Mishra received the best paper award in 'Fluids and Thermal Engineering' at the COMET'17 conference held at IIT(BHU) Varanasi on 8th April, 2017.

Manik Mittal received the first prize for best oral presentation of his paper 'Free vibrations of an elliptical cylinder at low Reynolds number' at NIT Delhi on 9th December, 2017.

Organization of short term course:

Organized a five day short term course in the Department of Mechanical Engineering, IIT(ISM) Dhanbad. The course titled 'CFD analysis of heat transfer and fluid flow problems using FEM and FVM' was conducted during July 3-7, 2017.

Organization of woskshop:

Organized a five day workshop in the Department of Mechanical Engineering, IIT(ISM) Dhanbad. The course titled 'Fluid-structure interactions involving rigid and flexible objects' was conducted during June 13-17, 2024.

Organization of webinar:

Under TEQIP-III, organized a two day webinar in the Department of Mechanical Engineering, IIT(ISM) Dhanbad. Two expert talks on 'Turbulence and its modelling' were arranged on 17^{th} and 19^{th} February, 2021.

Invited talks/seminars:

1. *Introduction to CFD* at the Department of Chemical Engineering, IIT(ISM) Dhanbad, on 29/1/2017 during the workshop 'Turbulence'.
2. *FEM in heat transfer and fluid flow: theory and applications* at the Department of Mechanical Engineering, Jadavpur University on 24/4/2017.
3. *Computational Fluid Dynamics for Beginners* at the Department of Mechanical Engineering, Institute of Engineering and Technology, Lucknow on 8/3/2018. This was an invited seminar in a TEQIP-III sponsored two day CFD workshop.
4. *Illustration of FDM, FVM and FEM techniques for 1-D heat conduction* on 14/6/2018 and 15/6/2018 at the short course (HTFFMM 2018) organized by the Department of Mechanical Engineering, NIT Durgapur.
5. *Some features of flow around stationary and freely vibrating square cylinders* at the Institute of High Performance Computing (IHPC) A*STAR, Singapore on 11/7/2018.
6. *Identification of the components of response in vortex-induced vibrations via oscillation frequency: theory and applications* at the Department of Mechanical Engineering, IIT Guwahati on 12/7/2019.
7. *FEM solution for one-dimensional, steady advection-diffusion equation* on 21/12/2019 at the Recent Advances in Fluid and Thermal Engineering (RAFTE 2019) organized by the Department of Mechanical Engineering, NIT Durgapur.
8. Delivered three online lectures, i.e. 1. *CFD principles and practices*, 2. *Tri-diagonal matrix using Thomas algorithm* and 3. *Different methods of solving the fluid flow and heat transfer problems* on 24/11/2020 and 26/11/2020 in the AICTE sponsored Faculty Development Program on *Advanced Computational Fluid Dynamics* organized by the Department of Mechanical Engineering, Institute of Engineering and Technology, Lucknow.
9. Delivered an online motivational talk to the first yearites of the Department of Mechanical Engineering, 2021 undergraduate batch, Jadavpur University on 12/11/2021.
10. Delivered an online lecture titled *FEM solution of heat conduction problems* on 24/1/2022 in the five-day faculty development program on *Physical Systems and Mathematical Modelling (PSMM-2022)* organized by the Departments of Mathematics and Physics, National Institute of Technology Calicut.
11. Delivered an invited lecture titled *The number of no-slip critical points and nature of rear stagnation point of an object* on 26/1/2023 in the five-day workshop on *Computational methods for fluid-solid interactions with special reference to numerical weather prediction* organized by

the Department of Mathematics and Computing, IIT(ISM) Dhanbad.
12. Delivered an invited lecture titled *Prediction of the upper limit of two-dimensional flow using two-dimensional computations* on 31/8/2023 in the six-day GIAN course on *Industrial & Vehicle Aerodynamics: A New Frontier for India's Economic Prosperity, Energy Security and Sustainable Environment* organized by the Department of Applied Mechanics, MNNIT Allahabad.
13. Delivered an online lecture titled *Flow around a square cylinder at* 45° *incidence at low Reynolds numbers* on 24/1/2024 in the SPARK India-Australia workshop on *Vehicle aerodynamics* organized by the Department of Applied Mechanics, MNNIT Allahabad during 11−25 January, 2024.
14. Delivered two invited lectures titled *Analytical results for flow-induced vibrations of an elliptic cylinder at indicence* and *Regimes of two-dimensional flow past a diamond cylinder* on 15/2/2024 and 16/2/2024, respectively in the five-day workshop on *Advances in Fluid-Solid Interactions using AI/ML with special reference to Numerical Weather Prediction and Smart Farming using IoT* organized by the Department of Mathematics and Computing, IIT(ISM) Dhanbad.
15. Delivered a lecture titled *Flow around a square cylinder at* 45° *incidence at low Reynolds numbers* on 29/2/2024 at the Department of Mechanical Engineering, NIT Durgapur.
16. Delivered an online lecture titled *Comparison of FDM, FVM and FEM in terms of 1-D heat conduction problem* on 14/4/2024 at the Workshop on Aeroelasticity, Biomechanics and Finite Element Analysis organized by the Department of Mechanical Engineering, IIT(ISM) Dhanbad during 13−14 April, 2024.
17. Delivered an invited talk on *Steady flow past a circular cylinder under large blockage* on 30/7/2024 at the Department of Mechanical Engineering, BITS Pilani Hyderabad Campus.

Extra-curricular: Runners up in hostel level Antakshari competition (held in February 1999) during B.E. in Jadavpur University.