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NABANITA DATTA

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Profile

A highly motivated, confident, energetic, self-starting, risk-taking, hardworking, meticulous, efficient and dedicated professor and R&D expert, tenured Faculty member for 10+ years at IIT Kharagpur, Consultant at GE Global Research and Tata Consultancy Services, among others; widely-travelled, internationally publishing and award-winning, having qualifications from premier institutes in India and United States, garnering a strong R&D as well as teaching-mentoring mindset, along with leadership skills in project and team management.

Experience

Associate Professor — **Indian Institute of Technology (IIT) Kharagpur** — **09.10.2020 – Till Date**

- Development: On-campus Small Wind Turbine Design, Construction, Fabrication and Assembly; leading 60+ people. (Separate PPT available)
- Research: Passive vibration control of structures with fractionally-damped viscoelastic foundation under dynamic and transient loads.
- Consultancy: Tata Consultancy Services, Indian Register of Shipping, Oceanergy Offshore engineering design and energy consultants, Mumbai.
- Teaching: Vibration of Floating Structures, Analysis of Ocean Structures, Design Lab.

Independent Consultant — **GE Global Research, Bangalore; Mechanics/Design division** — **18.01.2018–14.12.2018**

- Vibration analysis of Full-scale E-Stop tests of ECO110 wind turbines (WT) with three (03) outrigger dampers (using MATLAB), in both time-domain and frequency-domain, in order to estimate the damping efficacy: **quantification of damper effectiveness** for prototype dampers.
- Modelling of **Halidae-X** (12MW-220m) wind turbine towers as non-uniform tapered cantilever beams with tip mass and other concentrated masses: dry and wet vibration natural frequencies and modeshapes generation through **Rayleigh-Ritz method** using MATLAB, and comparison with ANSYS (Workbench).
- **Fluid kinetic energy estimate** for "added mass": quantification of tower frequency-reduction from dry to submerged state.
- Modelling of wind turbine dashpot dampers on wind turbine tower as *nodes* for **vibration analysis from first principles.**
  - ✓ Outrigger damper *position* optimization for critical damping using MATLAB.
  - ✓ Outrigger damper *constant* optimization for critical damping using MATLAB.
- **Non-classical foundation** modelling of WT tower, using Kelvin-Voigt translational and rotational dampers :
  - ✓ Dry and wet frequency and modeshape generation with outrigger-dampers.
  - ✓ Soil stiffness quantification for critical damping.
- **Sea state analysis** from offshore wind speeds : statistical and spectral representation of the sea using PM and JONSWAP spectra.
- **Quantification of** significant wave height and average wavelength generation for resonance-check (deep water waves).
- **Modelling of wave loads** on wind turbine tower from first principles of water wave mechanics.
- Comparison of wave loads from **BLADED** : Morison's equations vs. Radiation-Diffraction problem.
- Comparison of drag-dominance and inertia-dominance of hydroelastic tower dynamics using KC number.
- Total excitation wave force calculation using Haskind's relations.
- **Hydroelastic analysis** of offshore wind turbine under wind, waves, and seismic loads using MATLAB.
- **Wind load analysis** using Weibull distribution : probability and power spectral density generation.
- **Turbulent load analysis** using Kaimal spectrum.
- **Current load analysis** on WT tower : possibility of **vortex-induced vibration** (VIV) check.
- **Tsunami load analysis** on WT tower : possibility of quasi-static response analysis check.
- **Sponsored project writing** for *hydroelastic tool* generation for offshore wind turbine design and analysis : monopile tower depth optimization for various wind, wave and soil conditions.
- **Weekly Lecturing** on mechanical vibrations in the GE Global Research Design and Mechanics team study group.

Assistant Professor — **IIT Kharagpur, *Dept of Ocean Engg and Naval Arch*** — **27.05.2013 – 09.10.2020**

- **Research** (Theoretical and experimental) : Vibration and Fluid-structure of ocean structures : semi-analytical approaches.
  Journal and Conference publications, supervising of Research team (Doctoral (2) + PG (7) + UG students(18) (3^{rd} /4^{th} /5^{th} year)) : four UG students published in Elsevier journals, five (5) UG students presented at conferences designated as "*Top 10 Best conferences'* by IIT Kharagpur, three (3) students got International PhD scholarships, two students got international awards.

- **Teaching** at UG and PG level : taught both theory and lab courses, designed M.Tech elective course and Vibration Lab course, taught courses in Dept. of Mechanical and Civil Engg, conducted short-term courses.
- **Administrative** duties in Department and Institute levels (10 hours per week) : handling of student logistics; conducting of exams, viva-voce, seminars, conferences, general body meeting; maintenance in-charge.
- **Internal Collaborative work** : Vibration experiments in Dept. of Mechanical Engg, Aerospace Engg, and Electrical Engg, IIT Kharagpur; research contacts with Dept of Civil Engg, Electronics & Electrical Communication Engg, Agriculture & Food Engg., Physics & Meteorology, Geology & Geophysics, Centre for Ocean, Rivers, Atmosphere and Land Sciences.
- **External Collaborative work** : Propeller-induced vibration testing @ High Speed Towing Tank, Hydrodynamics Research Wing, Naval Science & Technological Laboratory, DRDO, Visakhapatnam.
- **Setting up of Vibration Lab**, underwater vibration testing facility design and development, instrument procurement (INR 30 lacs), aerofoil wing design and fabrication, cantilever plate fabrication.
- **Cost-effective model-making** of VIV-energy extractor : spring-mounted cylinder set-up constructed hands-on with INR 2000/-.
- **Model-testing** testing in circulation channel : vortex-induced vibration lock-in and synchronization : ONGC (New Delhi) observed and offered to fund the prototype-generation project in Jan 2017.
- **Product design and development** : On-campus small wind-turbine with indigenous GRFP blade fabrication and active yaw; on-site construction and assembly.

Visiting Faculty **IIT Kharagpur, *Dept of Ocean Engg and Naval Arch*** **10.06.2011 – 27.05.2013**

- Research (Theoretical) : conference publications, UG student research guidance.
- Teaching at UG and PG level : both theory and lab courses.
- Administrative duty in Department, Institute and Hostel levels (10 hours per week).

Faculty **Indian Maritime University, Visakhapatnam** **01.11.2010 - 31.05.2011**

- Teaching at UG and PG level : both theory and lab courses. • Administrative duty as hostel warden.
- Supervision of PG student in model-making of hovercraft, budget management, material procuring.

Education

Ph.D 2006-10 University of Michigan, Ann Arbor, USA. Naval Architecture and Marine Engineering

Doctoral Thesis *Hydroelastic response of marine structures to impact-induced vibrations*

- Kirchhoff's plate free vibration analysis using Galerkin's method in MATLAB : Eigen value analysis and generation of natural frequencies and plate modeshapes with convergence studies.
- Hydrodynamic impact load mathematical modeling and experimental comparison for various velocities and deadrise angles.
- Modal superposition method for transient dry and wet response analysis in MATLAB.
- 3D Boundary element method for fluid inertia estimation in MATLAB : calculation of wet natural frequencies.
- Shock response spectrum study for plates various aspect ratios, boundary conditions, impulse loading conditions.
- Influence of plate boundary conditions and aspect ratios on shock response spectrum.

Dual Degree 2001-06 Indian Institute of Technology, Kharagpur Ocean Engineering and Naval Architecture

Masters' Thesis *CFD analysis of propeller hydrodynamic performance using* GAMBIT/FLUENT

UG Thesis *Wave-making resistance CFD analysis of 12 hull forms using* SHIPFLOW*: hull form optimization*

Sponsored Projects

1. "*Setting up of Vibration Lab in the Department of Ocean Engineering and Naval Architecture, IIT Kharagpur*", January 2015 – December 2016, **Budget 25 lakhs.**
2. "*Mathematical tool development for hydroelastic analysis of propeller blade noise and vibration signature analysis*", Naval Research Board (Hydro-Vibro Acoustics Panel), Ministry of Defence, GoI. **Budget : 17 lakhs**, Duration : 3 years. Start : September 2020.
3. "In house Horizontal-axis Wind Turbine (HAWT) suitable for power generation at low wind spreads: design, fabrication, assembly, testing", IIT Kharagpur. **Budget : 6 lakhs**, Duration 6 months. Start September 2020.
4. "Vortex-energy extractor using lock-in", Seed grant for start-up incubation, Department of Science and Technology. **Budget 30 lakhs**.

Consultancy Projects

1. "*Development of MATLAB-based preliminary design and costing tool for wind turbines in India : Software transfer*", Indian Register of Shipping, Mumbai. Duration : 1 year, **Budget : 12 lakhs.**
2. "*Development of pipeline design codes : Software transfer*". Oceanergy Offshore engineering design and energy consultants, Mumbai. Duration : 6 months, **Budget : 6 lakhs.**

Industrial collaborations / contacts

- Garden Reach Shipbuilders and Engineers (GRSE), Ministry of Defence, Kolkata : Summer internship May 2003.
- Bharati Shipyard Limited (BSL), Mumbai, Thane, Ratnagiri : Summer internship May-June 2004.
- Naval Science and Technological Laboratory (NSTL), Vizag. : Internship Dec 2003, Experimentation (April 2015).
- Indian Register of Shipping (IRS), Mumbai .• Cybermarine Knowledge Systems Pvt. Ltd., Navi Mumbai.
- Oceanergy Offshore engineering design and energy consultants, Mumbai : offer to be in Board of Directors, May 2015.
- General Electric Global Research, Bengaluru (2018) • Shell Technology Centre, Bengaluru (October 2017)
- Boeing Intl. Corp. Pvt. Ltd, Bangalore • Airbus Group Inc, Bangalore • Siemens-Gamesa, Bangalore / Gurgaon.
- General Motors, Research and Development Centre, Bangalore

Skills

- **Research and Innovation** : analytical proficiency, problem formulation and analysis, MATLAB programming, critical thinking, quantitative data collection and analysis, evaluation and problem-solving, results assessment, technical writing, physical modelling.
- **Project conception** : Problem identification, closing the gap between science and engineering, orienting research approach and targeting results of technological relevance; time-line estimation, man-power requirement estimation, proposal writing.
- **Project management** : team and staff management, coordination, doctoral student guidance, research collaborations.
- **Experimentation** : laboratory set-up, budget strategy, instrument procuring, laboratory PG-level course design, data assessment, workshop practice, manpower coordination, resource management and maintenance.
- **Teaching and Training** : classroom teaching, content development, technical communication, student mentoring, short-term courses.
- **Administration** : *hostel warden* for 2 years (maintenance, development, budget strategy, supplier and vendor recruitment, discipline maint.); *faculty adviser* for 7 years (student academic logistics, mentoring, academic project coordination).
- **Tools known** : **MATLAB**, C, C++, LateX, AutoCAD, Solidworks, SHIPFLOW, NVGate OROS, ME'scope (VibTech), ANSYS 18.0 (Workbench), ANSYS-FLUENT, QBLADE, STAAD.Pro, Python.
- **Basic Machine Learning**, using Python 2.7.

Publications

Book Chapter - 1 (Springer), **Journal**–Published-27, Under review–2, Under construction–2, **Conference proceedings** -21

Google Scholar link : https://scholar.google.co.in/citations?user=sLv79k4AAAAJ&hl=en

ResearchGate link :https://www.researchgate.net/profile/Nabanita_Datta

Book Chapter

1. Vibro-Impact Dynamics of Ocean Systems and Related Problems; Ch 6, "*Hydrodynamic impact-induced vibration characteristics of a uniform Euler-Bernoulli beam", by* Datta N., Kim D.;Troesch, A.W.; Springer, 2009; ISBN 978-3-642-00628-9, pp.53-66.

Journal publications : Published / In Press

1. Datta, N.,Troesch, A.W., *Hydroelastic response of Kirchhoff plates to transient hydrodynamic impact loads,* **Marine Systems and Ocean Technology**, Vol 7, No.2, 77-94 (2012) .
2. Mandal, S., Datta, N., Sahoo, T., *Hydroelastic analysis of surface wave interaction with concentric porous and flexible cylinder systems* **Journal of Fluids and Structures**, 42, 437-455 (2013).
3. Ankit, Datta, N., "*Free transverse vibration of ocean tower*", **Ocean Engineering,** Vol 107 (2015) 271–282.
4. Ankit, Datta, N.,Kannamwar, A. N., "*Free transverse vibration of mono-piled ocean tower*", **Ocean Engg**116 (2016) 117–128.
5. Datta, N. and Thekinen, J. D.,*"A Rayleigh-Ritz based approach to characterize the vertical vibration of non-uniform hull girder*", **Ocean Engineering** Vol 125(2016), 113-123.
6. Datta, N., Siddiqui, M. A., "*Hydroelastic analysis of axially loaded Timoshenko beams with intermediate end fixities under hydrodynamic slamming loads"*, **Ocean Engg** Vol 127(2016), 124-134.
7. Datta, N., Verma, Y., *"Accurate Eigenvector-based generation and computational insights of Mindlin's plate modeshapes for twin frequencies",* **International Journal of Mechanical Sciences** Vol 123 (2017), 64-73.
8. Datta, N., Kannamwar, A.N.,Verma, Y., Panda, A. "*Free Dry Vibration of low aspect-ratio cantilever wing : Semi-analytical and Numerical Analysis with Experimental Verification*", **Journal of Ship Production and Design**, Vol.33, No.3 (2017), 1-10.
9. Datta, N., "*Dynamic analysis of a partially submerged Compliant Tower with superstructure as a non-uniform Timoshenko beam with a non-classical foundation, due to marine environmental loads*", **Journal of Marine Science and Application (Springer),** Special Issue on Fluid Structure Interaction. (2017) (In press).
10. Datta,N., Thekinen, J.D, "*Transient point load induced wet vibration of Kirchhoff's plate with translationally constrained edges : aircraft landing on floating airports*", **Marine Systems and Ocean Technology (Springer),**Vol.12 (2017), No.4, 252-261.
11. N.Datta*, "Vortex-induced vibration of a tension leg platform tendon: multi-mode limit cycle oscillations",* **Journal of Marine Science and Application,** Special Issue on Fluid Structure Interaction**(Springer),** Vol.16, No.4 (2017), 458-464.

12. N.Datta, Y.Verma, "*Analytical scrutiny and prominence of rigid-body modes in vibration of plates with translational edge restraints*", **International Journal of Mechanical Sciences,** Vol 135, (2018), 124-132.
13. Y.Verma and N.Datta*, "Application of translational edge restraint for vibration analysis of free edge Kirchhoff's plate including rigid-body modes*", **Engineering Transactions (Institute of Fundamental Technological Research, Poland),** 66, 1, 1-40, 2018.
14. Datta, N., Jindal, R., "*Forced wet flexural dynamics of spade rudder in propeller slipstream : semi-analytical approach of pivoted FFFF plate"*, **Marine Systems and Ocean Technology** Vol 13 (2018), 26-33. **DOI** https://doi.org/10.1007/s40868-018-0042-x.
15. Y.Verma and N.Datta, "*Vibration of Mindlin's plates with rotationally constrained edges : the advantage of dynamic closed-form non-classical admissible functions in Rayleigh-Ritz method.*", **Engineering Transactions (Institute of fundamental Technological Research, Poland),** 66, 2, 1-32, 2018.
16. Ankit, Datta, N.; "*Free vibration of a compliant tower modelled as a partially wet tapered Timoshenko beam with intermittent mass and stiffness variations, eccentric tip mass, and non-classical foundation*", **Journal of Marine Science and Application, Springer**, 2018. **DOI** : https://doi.org/10.1007/s11804-018-0035-3.
17. Datta, N.; Siddiqui, Mohd. Atif, "*Impact-induced flexural response of axially loaded uniform Timoshenko beams with non-classical ends*", **Marine Systems and Ocean Technology, Springer** 2018. DOI: https://doi.org/10.1007/s40868-018-0048-4.
18. N.Datta, R.Jindal, "*Modelling a spade rudder as a hollow two-way tapered Kirchhoff's plate : free dry and wet vibration study with numerical verification*", **Applied Ocean Research,** Vol 82, 385-396, 2019.
19. Datta, N., Thekinen, J.D., *"Wave-induced flexural response of idealized non-uniform hull girder in random seas",* **Marine Systems and Ocean Technology, Springer** 2018. DOI :https://doi.org/10.1007/s40868-018-0051-9.
20. Y. Verma, N. Datta, R. K. Praharaj, "*A semi-analytical vibration analysis of partially wet square cantilever plate with numerical and experimental verification : partially wet modeshapes*", **Journal of Vibration and Acoustics (ASME),** 141, 2019. doi:10.1115/1.4043351.
21. J.D.Thekinen, N.Datta , "*Rayleigh-Ritz method-based analysis of dry coupled horizontal-torsional-warping vibration of mathematical open-section containership hulls*", **Applied Ocean Research,** Vol 86, 73-86, 2019.
22. R.K. Praharaj, N.Datta, Y.Verma, M. R Sunny, "*Transverse vibration of thin rectangular orthotropic plate with non-classical edge boundary conditions: a semi-analytical approach*", **Iranian Journal of Science and Technology, Transactions of Mechanical Engineering.** 2019 DOI : https://doi.org/10.1007/s40997-019-00337-5.
23. R.K. Praharaj and N. Datta, "*Dynamic response of fractionally damped viscoelastic beams and plates subjected to a moving force load*", **Journal of Vibration and Acoustics (ASME),** Vol. 142, 2020. https://DOI:10.1115/1.4046485.
24. R.K. Praharaj, N.Datta,"*Dynamic response spectra of fractionally damped viscoelastic beams subjected to moving load*", **Mechanics Based Design of Structures and Machines**, an International Journal (2020). https://doi.org/10.1080/15397734.2020.1725563
25. R.K. Praharaj and N. Datta, "*Dynamic response of Euler-Bernoulli beam resting on fractionally damped viscoelastic foundation subjected to a moving point load*", **Journal of Mechanical Engineering Science (Part C).** (2020).
26. R.K. Praharaj and N. Datta, "*Dynamic response of plates resting on a fractional viscoelastic foundation and subjected to a moving load".* **Mechanics Based Design of Structures and Machines,** an International Journal. (2020) https://doi.org/10.1080/15397734.2020.1776621
27. R.K. Praharaj and N. Datta, "*On the transient response of the plates resting on fractionally damped viscoelastic foundation*", **Computational and Applied Mathematics,** Elsevier (2020).

Journal publications : Under Review

1. N.Datta, A.N. Kannamwar, Y.Verma. A.Panda, "*Free wet vibration of low-aspect-ratio cantilever lifting surface: semi-analytical and numerical approach with experimental verification*", **Journal of Ship Production and Design**
2. N.Datta, Md. Ishtiyak, Y. Omkar Venkata, L.S.Lingesh, V.Gupta, A.Attri, "*Capturing synchronized Vortex-induced vibration of spring-mounted cylinder at mass ratio less than one with numerical modeling and verification"*, **Marine Structures (Elsevier)**

Conference Proceedings (Presenter is underlined)

1. Datta N., Kim D. , Troesch A.W., "*Hydrodynamic impact-induced vibration characteristics of a uniform Euler-Bernoulli beam"*, **International Symposium on Vibro-Impact Dynamics of Ocean Systems and Related Problems**, Troy, Michigan, Oct 2008.
2. Datta N., Troesch A.W., "*Slam-induced vibration characteristics of a Kirchhoff's plate"*, **FAST Sea Transportation Conference**, Athens, Greece, October 2009.
3. N.Datta, J.D. Thekinen, *"Response spectrum of non-uniform mathematical hull girder springing to deep water random seas with forward speeds*", **8th Intl Conference in Marine Technology**, Malaysia, October 2012.
4. N.Datta, J.D. Thekinen, *"Higher-order dry and wet natural frequencies and modeshapes of rectangular Kirchhoff's plate vibration",* **3rd Asian Conference on Mechanics of Functional Materials and Structures**, IIT Delhi, 2012.
5. N.Datta, Md. AtifSiddiqui, "*Dynamic response of axially loaded plates with intermediate fixities to transient hydrodynamic impact loads*", **32nd Intl Conference on Ocean, Offshore and Arctic Engg (OMAE2013)**, Nantes, France, June 08-13, 2013.

6. N.Datta, J.D.Thekinen, "*Wet vibration of axially loaded elastically supported plates to moving loads : aircraft landing on floating airports*", **32nd Intl Conference on Ocean, Offshore and Arctic Engg (OMAE2013),** Nantes, France, June 08-13, 2013.
7. N.Datta, Md. Atif Siddiqui, "*Dynamic response of axially loaded Timoshenko beams with intermediate fixities to repeated transient hydrodynamic impact loads*", **2nd International Conference on Advances in Structural, Civil and Environmental Engg(SCEE2013)**, Kuala Lumpur, Malaysia, May, 2013.
8. N.Datta, Ankit, "*Forced damped wet vibration analysis of an idealized compliant tower in the Indian Ocean, with superstructure due to current loads, wave excitation, and earthquake impulses*", Proceedings of the **33rd International Conference on Ocean, Offshore and Polar Engg (OMAE2014),** San Francisco, USA, June 2014.
9. N.Datta, A.N. Kannamwar, "*Free vibration of marine rudder: theoretical and numerical analysis with experimental verification",* **SNAME Maritime Convention**, Houston, USA, Oct 20-25, 2014. (**Elmer L. Hann Award 2015**).
10. N.Datta, R. Jindal, "*Free dry and wet vibration of 2-way tapered hollow marine rudder with non-classical pivot : theoretical study*", Proc. of **the 34th Intl Conference on Ocean, Offshore & Polar Engg (OMAE2015)**, St. John's, Canada, June 2015.
11. N.Datta, R. Jindal, "*Wake-induced flutter of 2-way tapered hollow stiffened marine spade rudder in non-uniform propeller slipstream*", **22nd Intl Congress on Sound and Vibration**, Italy, July 12-16, 2015.
12. N.Datta, P. Sinha, A. N.Kannamwar*, "Vortex-induced vibration of a tension leg platform tendon: multi-mode limit cycle oscillations",* ICSOT India, RINA, December 2015.
13. N.Datta, A.N. Kannamwar, Y.Verma, "*Wet vibration of low-aspect-ratio wing: semi-analytical and numerical approach with experimental investigation*", Proceedings of **the 36th International Conference on Ocean, Offshore and Polar Engineering (OMAE2017)**, Trondhiem, Norway, June 2017.
14. Mohd. Ishtiyak, N.Datta, O. Venkata, V. Gupta, A. Attri, L.S. Lingesh, "*Harvesting of hydrokinetic energy by enhancing-vortex induced vibration of a submerged cylinder*", ICSOT India, RINA, December 2017.
15. Mohd. Ishtiyak, N.Datta, O. Venkata, V. Gupta, A. Attri, L.S. Lingesh, "*Experimental vortex-induced vibration of spring mounted cylinder: achieving lock-in*", ICSOT India, RINA, December 2017.
16. Y.Verma, N.Datta, R.Praharaj, "*Closed-form vibration analysis of rectangular simply supported Mindlin plates with multiple stiffeners*", **25th International Congress on Sound and Vibration (ICSV25)**, Hiroshima, Japan, July 8-12, 2018
17. R. K. Praharaj, N. Datta, "*Application of Fractional Calculus in Modelling Viscoelastic Foundation of Ship Structures for Passive Vibration Control*", Proceedings of **the 39th International Conference on Ocean, Offshore and Polar Engg (OMAE2020)**, Florida, USA, June 28 – July 03, 2020.
18. A. R. Krishnanunni, N. Datta, "*A Simplified Procedure to Calculate the Natural Frequencies of a Small Wind Turbine Blade with Centrifugal Loads*", Proceedings of **27th International Congress on Sound and Vibration (ICSV27)**, Prague, Czech Republic, July 12-16, 2020.
19. D. Swaroop, H. S. Chambhare, A. R. Krishananunni, N. Datta, "*Dynamic Response Analysis of Truss Tower for Customized Small Rooftop-Mounted Wind Turbines in Rarhi Bengal*", Proceedings of **27th International Congress on Sound and Vibration (ICSV27),** Prague, Czech Republic, July 12-16, 2020.
20. A. R. Krishnanunni, N. Datta, H. S. Chambhare, D. Swaroop, "*Basic Design And Blade Structural Analysis Of A Small Horizontal-Axis Wind Turbine For Low Wind Speeds*", Proceedings of **Power2020 Power Conference (ASME)**, Anaheim, California, USA, Aug 02-06, 2020.
21. N. Datta, D. Swaroop, A. R. Krishananunni, H. S. Chambhare, K. K. Soni, D. Sen**,** "*Basic Design and Feasibility Study of a Small Stand-Alone Low-Cost Horizontal Axis Wind Turbine (HAWT) for Rural Use on the Cyclone Prone East Coast of India*".

Research and Innovation @ IIT Kharagpur

- **Global dry and wet vibration of extremely non-uniform hull girders** using Rayleigh-Ritz method in vertical and horizontal-torsional-warping modes : The hull was modelled mathematically using section-wise superellipses.
- **Transient point load induced response of translationally edge restrained plat**e : aircraft landing on floating airports.
- **Hydroelastic interaction** of axially loaded Timoshenko beams with non-classical end fixities, to hydrodynamic slamming loads.
- **Fluid-structure interaction** (wave) and **soil-structure interaction** (earthquake) of offshore structures by Rayleigh-Ritz with FEA verification. The foundation was first considered as a non-classical base, and then a monopile.
- **Aerofoil Wing vibration** : both dry, wet, and propeller-induced vibration. (This topic included (i) in-house dry and wet model testing and (ii) DRDO experimental work.)Modelling a pivoted spade rudder as a hollow two-way tapered **Kirchhoff's plate** : free dry and wet vibration semi-analytical study with numerical verification.
- **Vortex-induced vibration** of a tension leg platform tendon.
- Energy-extraction through **vortex-induced vibration** : Experimental work to synchronize alternate vortex-shedding and oscillating model-scale prime-mover.
- Accurate Eigenvector-based generation and computational insights of **Mindlin's plate** modeshapes for twin frequencies.
- Application of translational edge restraint for vibration analysis of free edge plate including rigid-body modes.

- Vibration of thin rectangular orthotropic plate with non-classical edge boundary conditions.
- **Dynamic analysis of viscoelastic structures** : Dynamic analysis of fractionally-damped beam supported on a continuous viscoelastic foundation subject to moving point load.
- **Offshore wind turbine analysis** : MATLAB-based tool development of monopile-depth optimization in Indian territorial waters.
- **Wind turbine blade vibration analysis** : MATLAB-based tool development for wind blade geometry optimization for a given location.
- Mathematical tool development for hydroelastic analysis of propeller blade noise and signature analysis.
- Indigenous design of Small Wind Turbine Blade.
- FRP-Fabrication of small wind turbine blade using hand-lay-up technique.

Lab Set-up at @ IIT Kharagpur (2015-17)

Procured and set-up the following :

1) 8-channel FFT multi-analyzer
2) Electrodynamic Shaker
3) Dry accelerometer, Underwater accelerometer with magnetic mount,Impact hammer
4) Underwater test facility : 4' × 4' × 2.5' : design, material procurement, fabrication, installation.
5) Underwater strain gauge
6) NVgate OROS software
7) Modal analysis Software : MEScope
8) Design, cost estimate, material procurement, fabrication, installation, maintenance of the following experimental specimens: Cantilever wing, pivoted rudder, cantilever square plate, circular aluminum plate, spring-mounted cylinder, compression springs.

Research Guidance and Teaching

- **Students guided** : PhD (2), 2-year M.Tech (3), Dual Degree M.Tech (4), B.Tech (15), 3rd year (25+), MBA (5).
- **Courses taught** : PG Level (6 subjects = 2 Theory + 4 Lab), UG level (11 subjects = 9 Theory + 2 Lab).

Thesis guided for PhD / M.Tech / Dual Degree / B.Tech / MBA

Ph.D

1. **Yogesh Verma** (Ph.D 2014-19). *Free dry and wet vibration of plates including rigid body modes through semi-analytical approach with experimental verification.*
2. **Rajendra Kumar Praharaj** (Ph.D 2017-2021). *Passive vibration control of continuous structures with viscoelastic foundation under dynamic and transient loads.*

2-year M.Tech

3. **L.S. Lingesh** (2-yr M.Tech 2015-16). *Experimental vortex-induced vibration of spring mounted cylinder: achieving lock-in.*
4. **Mohd. Ishtiyak** (2-yr M.Tech 2016-17). *Harvesting of hydrokinetic energy by enhancing-vortex induced vibration of a submerged cylinder.*
5. **Y. Omkar Venkata** (2-yr M.Tech 2017-18). *Numerical study of vortex-induced vibration for hydro-kinetic energy extraction*.

Dual Degree M.Tech

6. **Joseph D. Thekinen** (Dual Degree 2012-14)
   - *Rayleigh-Ritz method-based analysis of dry coupled horizontal-torsional-warping vibration of mathematical open-section containership hulls.*
   - *Transient point load induced wet vibration of Kirchhoff's plate with translationally constrained edges : aircraft landing on floating airports.*
7. **Ankit** (Dual Degree 2013-15)
   - *Free transverse vibration of mono-piled ocean tower.*
   - *Dynamic analysis of a partially submerged Compliant Tower with superstructure as a non-uniform Timoshenko beam with a non-classical foundation, due to marine environmental loads.*
8. **Ameya N. Kannamwar** (Dual Degree 2013-15)
   - *Free dry and wet vibration of marine rudder: theoretical and numerical analysis with experimental verification.*
   - *Free vibration of marine rudder: theoretical and numerical analysis with experimental verification.*
9. **Mr. Athrey Ranjith Krishnanunni** (M.Tech 2019-2020, Dept. of Aerospace Engineering). *In-house design and fabrication of concentrator-augmented horizontal axis wind turbine : Wind Analysis, Concept and Basic Design, Blade Design, Component Layout Design.*

B.Tech

10. **Mohd. Atif Siddiqui** (B.Tech 2012-13). *Dynamic response of axially loaded plates with intermediate fixities to transient hydrodynamic impact loads.*
11. **Rahul Jindal** (B.Tech 2014-15). *Theoretical analysis of free and forced dry and wet vibration of 2-way tapered hollow marine rudder with numerical verification.*
12. **Prateek Sinha** (B.Tech 2014-15). *Vortex-induced vibration of a tension leg platform tendon: multi-mode limit cycle oscillations.*
13. **Ashish Shukla** (B.Tech (2015-16). *Shock response spectrum of elastically supported circular helideck under axisymmetric impact due to helicopter landing.*
14. **C. Ravindra** (B.Tech 2015-16). *Finite element analysis of beams with various complications : Timoshenko beam, intermediate end fixities, multi-span beams, Stepped beam, beams with concentrated masses.*
15. **Vishal Kumar Gupta** (B.Tech 2017-2018)
16. **Abhinav Attri** (B.Tech 2017-18)
17. **Anshuman Panda** (B.Tech 2017-18)
18. **N. Mahesh Babu** (B.Tech Spring 2019). *MATLAB-based tool development of monopile-depth optimization of offshore wind turbine in Indian territorial waters.*
19. **Mr. Diwakar Swaroop** (B.Tech 2019-2020, Dept. of Mechanical Engineering). *In-house design and fabrication of concentrator-augmented horizontal axis wind turbine : Mechanical design of Drive-train, Machinery Selection, Structural design of tower and foundation, Protection Design.*
20. **Mr. Hrushikesh Chambhare** (B.Tech 2019-2020). *In-house design and fabrication of concentrator-augmented horizontal axis wind turbine : Composite fabrication, Planning and Production design, Economics and Operations Research.*
21. **Mr. Umang Agarwal** (B.Tech Autumn 2020). Dept. Of Mechanical Engineering. *Design and Construction of a Solar-Powered Lawn Mower : Green-Cover Study, Concept Design, Basic Design, Blade Design, Detailed Design, Construction, Operation, Cost Estimate.*
22. **Mr. Shivam Pandey** (B.Tech Autumn 2020). Dept. of Mechanical Engineering. *Design and Construction of a Solar-Powered Lawn Mower : Green-Cover Study, Concept Design, Basic Design, Blade Design, Detailed Design, Construction, Operation, Cost Estimate.*
23. **Mr. Yash Goyal** (B.Tech, Spring 2021), Dual Degree in Engineering Entrepreneurship. *Design and Construction of a Solar-Powered Pest Repellent: Basic Design, Detailed Design, Construction, Operation, Cost Estimate.*
24. **Mr. Jus Jasinghani** (B.Tech 2021-22). *In-house design and fabrication of concentrator-augmented horizontal axis wind turbine: blade fabrication, drive train assembly, control systems assembly.*

MBA (AMRP : Applied Market Research Project)

25. **Arka Pal** (AMRP Spring 2021), Vinod Gupta School of Management, *Business Plan & Marketing Research Biogas Plant in Kharagpur.*
26. **Sagnik Chattopadhyay** (AMRP Spring 2021), Vinod Gupta School of Management, *Market Research and Market size analysis of Wind energy in India.*
27. **Dhiyeri P Joy** (AMRP Spring 2021), Vinod Gupta School of Management, *Market Research and Market size analysis of Wind energy in India.*
28. **Palash Ninawe** (AMRP Spring 2021), Vinod Gupta School of Management, *ADITI Jute-Based Sanitary Pad : Market Research & Business Plan.*
29. **Sayan Sarkar** (AMRP Spring 2021), Vinod Gupta School of Management, *TRINA LAWN MOWER : Market Research and The Business plan.*

Audit

30. **Mr. Unnikrishnan Nambiar K.**, Dual Degree in Financial Engineering. *Feasibility Study and Cost Analysis of Small Wind Turbine on the Coast of West Bengal : Site Assessment, Wind Data Analysis, Soil Study, Wind Farm Micro-siting, Machine Size Optimization, Cost Estimate, Business Model.*
31. **Mr. Nirbhay.** *In-house design and fabrication of concentrator-augmented horizontal axis wind turbine: Drive train and nacelle assembly.*
32. **Mr. Pritam Das.** *In-house design and fabrication of concentrator-augmented horizontal axis wind turbine: Design of control systems.*
33. **Ms. Bhaswati Sen.** *In-house design and fabrication of concentrator-augmented horizontal axis wind turbine: Instrumentation.*

Technical Reports

1. "*Dynamic analysis of Halide-X offshore wind turbine under environmental loads, including outrigger dampers : parametric study*", GE Global Research, Bangalore, December 2018.

Positions Held

1. **Vibration Laboratory in-charge**, Department of Ocean Engineering and Naval Architecture (OE&NA), 2013-till date : *developed* the Vibration Laboratory from scratch, *procured* instruments, *designed* Lab course, *conducted* experiments with research team.
2. **Department PhD. Scholars' coordinator,** July 2019 – till date .
3. **Department Training and Placement In-Charge (UG), July 2020 – till date.**
4. **Department Library in-charge**, Department of OE&NA, 2013-2017 : *created* an online library of books and theses.
5. **Director's Nominee**, Advisory Board (Technology), Technology Students Gymkhana, IIT Kharagpur, 2017-2018.
6. **Assistant warden** (Maintenance), Sarojini Naidu/Indira Gandhi Hall of Residence, IIT Kharagpur, 2012-14 :*renovated* the SN Hall kitchen, *controlled* alcohol menace with raids, *restarted* the Xerox centre, *developed* new common room.
7. **Faculty Adviser**, Department of OE&NA, batch of 2013-18 : *Guided* the batch with semester-opening PPTs, *distributed* industrial contacts among students, *conducted* the most punctual Grand Viva for 2 days for 4thYr (April 2017).
8. B.Tech/M.Tech Project coordinator, Department of OE&NA, 2016-18 : *monitored* three parallel sessions in one day.
9. **Teaching assistant coordinator**, Department of OE&NA, 2017 : *streamlined* all doctoral manpower into relevant courses for tutorials and Laboratory support for the first time in the Dept. of OE&NA.
10. **General Secretary (Mess)**, Sarojini Naidu/Indira Gandhi Hall of Residence, IIT Kharagpur, 2003-04 : *Won* the Best Hall Council Member Award 2003-04, *created* a new food preference card system, *improved* food quality and variety.

Awards/Honours

1. Silver Award (INR 2,50,000/-) KPIT Sparkle 2020 for product development "Vortex-energy generator".
2. International Research Awards 2020 for the excellence in "*Modelling a spade rudder as a hollow two-way tapered Kirchhoff's plate : free dry and wet vibration*", awarded by, RULA AWARDS & IJRULA, with World Research Council & United Medical Council.
3. Research Adviser, Nan Yang Academy of Sciences, Singapore, January 2019 onwards.
4. Elmer L. Hann Award 2015 for the paper "*Free Vibration of Marine Rudder : Theoretical and Numerical analysis with Experimental Verification*", SNAME Maritime Convention, Houston, USA, Oct 2014.
5. Fellowship and Research assistantship from the University of Michigan, Naval Arch and Marine Engg, March 2006.
6. First prize in the Dynamic Systems & Modelling, Engg Graduate Symposium, University of Michigan, November 2008.
7. Travel Grant from University of Michigan Ann Arbor FAST Sea Transportation Conference, Athens, October 2009.
8. Travel grant from IIT Kharagpur for 8th International Conference in Marine Technology, Malaysia, October 2012.
9. Full funding from IIT Kharagpur for 22nd International Congress on Sound and Vibration, Italy, July 2015.
10. Full funding from IIT Kharagpur for 36th Intl Conf on Ocean, Offshore and Polar Engg, Trondheim, Norway, June 2017.
11. Best Hall Council member, 2003-04, Sarojini Naidu/Indira Gandhi Hall of Residence, IIT Kharagpur.

Invited talks/seminars

1. "*Whipping and Springing of Hull girder*", **Indian Register of Shipping**, Mumbai, September 2015.
2. "*Vibration of Marine Structures*", **Cybermarine Knowledge Systems Pvt. Ltd**, Navi Mumbai, Sept 2015.
3. "*Hydroelastic vibration of marine structures to hydrodynamic impact loads*", **Indian Maritime University**, Visakhapatnam, November 2010.
4. "*Flexural response of marine structures to hydrodynamic slamming*", **Naval Science and Technological Laboratory** (DRDO), Visakhapatnam, January 2011.
5. "*Hydroelastic vibration of marine structures to hydrodynamic impact loads*", **IIT Madras**, Ocean Engg. June 2011.
6. "*Vibration of Ocean Structures*", Dept. of Mechanical Engg., **IIT Bombay**, September 2015.
7. "*Dynamic effects of ship responses in irregular sea*", in short-term course "Seakeeping & Maneuvering", April 2016.
8. "*What is feminism and why it means a whole lot more to the world in the current scenario?*", Panel talk at YouthSpeak Forum by AIESEC IIT Kharagpur, Oct 22, 2016.
9. "*Harvesting of hydrokinetic energy by enhancing vortex-induced vibration of a submerged cylinder",* **School of Energy Sciences, IIT Kharagpur**, Feb 9, 2017.
10. "*Wave forces and Structures*" and "*Body response in waves*", lectures as part of the short-term course titled "Mechanics of Floating and Submerged Bodies", February 2017.
11. "*Women's participation in the overall technological growth of the nation, and in the R & D sector. What has improved, and what needs further improvement*?", panel discussion titled "Manthan" on the theme "This time, the centre is India", as a part of the *Sankalp Se Siddhi* campaign of Government of India, 2017-22, on Sept 2, 2017.
12. "*Freedom of Expression and Rational Thinking - problems and tasks ahead*", Panel Discussion, organized by Breakthrough Science Society, IIT Kharagpur Chapter, Sept 2017.
13. "*Mechanical Vibrations, Fluid-Structure Interaction, Renewable Energy*", **GE Global Research**, Bangalore.
14. "*Vibration of Ocean structures*", **Shell Technology Centre**, Bangalore, August 2018.

15. "*Theoretical vibration analysis of lifting surfaces*", **Boeing India Pvt. Ltd.**, Bangalore, November 2018.
16. "*Free dry and wet vibration of plates including rigid body modes through semi-analytical approach with experimental verification",* **Indian Institute of Science** (IISc), Bangalore, December 2018.
17. TEQIP-III Sponsored Seminar on "*Offshore Wind Turbines and Supporting Structures*", Department of Civil Engineering, National Institute of Technology (NIT), Jamshedpur, June 2019.
18. "*Small Wind turbine design and fabrication : opportunities and challenges*", Advances of Renewable Energy in higher education and research", Conference by MNRE and the Department of Hydro and Renewable Energy (HRED), IIT Roorkee. December 2021.

References

1. **Prof. Armin W. Troesch**, Department of Naval Architecture and Marine Engineering, College of Engineering, University of Michigan, 2600 Draper Road, Ann Arbor 48109. (Email : troesch@umich.edu)
2. **Dr. B. Vidyashankar**, Principal Engineer, General Electric Global Research, John F. Welch Technology Centre, Bangalore. (Email : Vidyashankar.Buravalla@ge.com)
3. **Prof. Dhrubajyoti Sen, Dean of Students Affairs and Professor,** Department of Civil Engineering, Indian Institute of Technology, Kharagpur, West Bengal Pincode 721302 (Email : djsen@civil.iitkgp.ernet.in)
4. **Prof. Sudhirkumar Barai,** Director, BITS Pilani. Vidya Vihar, Pilani, Rajasthan 333031 Email: director@pilani.bits-pilani.ac.in
5. **Prof. N. K. Kishore.** Department of Electrical Engineering, Indian Institute of Technology, Kharagpur. West Bengal Pincode 721302 (Email : kishor@ee.iitkgp.ac.in)