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### AREAS OF EXPERTISE

- **Nanomechanics** – Role of defects and fluctuations; Elastic properties; Molecular dynamics algorithms; Structure-property optimization; Dissipation
- **Probabilistic mechanics** – Damage and fracture mechanics; Statistical modeling of random load/environmental processes; Structural reliability; Probability based design and acceptance criteria

### EDUCATION

January 1997	<b>Doctor of Philosophy</b> in Civil Engineering <i>The Johns Hopkins University, Baltimore, MD, USA</i> <i>Dissertation: "A Damage Mechanics-Based Approach to Structural Deterioration and Reliability"</i>
May 1994	<b>Master of Science</b> in Engineering <i>The Johns Hopkins University, Baltimore, MD, USA</i>
May 1991	<b>Bachelor of Technology (Hons.)</b> in Civil Engineering <i>Indian Institute of Technology, Kharagpur, India</i>

### EXPERIENCE

<b>Indian Institute of Technology Kharagpur, India</b> <i>Department of Civil Engineering</i>  <i>Center for Theoretical Studies</i>  <i>Civil Construction and Maintenance</i>  <i>Alumni Affairs and International Relations</i>	<b>Professor</b> <b>Associate Professor</b> <b>Assistant Professor</b>  <b>Associate Faculty</b>  <b>Chairman</b>  <b>Associate Dean</b>	December 2011 – present April 2007 – December 2011 February 2006 – April 2007 March 2016 – present  October 2013 – Sept 2016  October 2016 - present
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<b>The Johns Hopkins University, Baltimore, MD, USA</b> <i>Dept. of Civil Engineering</i>	<b>Visiting Faculty</b>  <b>Post-Doctoral Fellow</b>	June 2012 – May 2013  January 1997 – March 1998
<b>University of Delaware, Newark, DE, USA</b> <i>Department of Civil and Environmental Engineering</i>	<b>Adjunct Professor</b> <b>Assistant Professor</b> <b>Scientist</b>	January 2010 – present July 2001 – February 2006 July 2000 – June 2001
<b>Stanford University, Stanford, CA, USA</b> <i>Department of Civil and Environmental Engineering</i>	<b>Visiting Assistant Professor</b>	August 2005 – December 2005
<b>American Bureau of Shipping, Houston, TX, USA</b> <i>Advanced Analysis Department</i>	<b>Engineer</b>	March 1988 – February 2000

## RESEARCH CONTRIBUTIONS

<p><b>1. Non-equilibrium statistical mechanics and molecular dynamics algorithms:</b> Created three new deterministic molecular dynamics thermostats and improved the ergodic characteristics of existing ones. One of these is the full phase space “PB thermostat” that for the first time uses all phase space variables to control temperature. This thermostat is found to be superior to existing methods in non-equilibrium scenarios. Also, proposed new algorithms for parallelizing MD codes.</p> <p>Work on heat transport in small scale systems has led to maximum relative entropy based estimation of density functions and a new steady state fluctuation theorem for estimating free energy that will help experimentalists obtain equilibrium thermodynamic properties much more efficiently. A novel heat pump mechanism has shown that refrigeration is possible without particle transport or work done on the medium.</p>
<p><b>2. Phononic origins of friction and thermophoresis:</b> Investigated the role of phonon in thermal transport, friction and thermophoresis at the nanoscale and how interface geometries can be tuned to give rise to desirable friction properties in nanoscale devices. Working on CNT oscillators, found that frictional dissipation depends significantly on interface features such as contact area, commensurability and endcapping of the inner core. Other findings include how energy is transferred between the tubes, how individual phonons in the outer tube near the interface respond to the sliding inner CNT, and how longitudinal acoustic phonon mode can initiate sliding motion of the core. Also found the radial breathing and twisting acoustic modes are the enablers of ultra-low friction in CNT oscillators.</p>
<p><b>3. Continuum damage mechanics and stochastic CDM:</b> Derived a set of coupled partial differential equations describing pre-localization damage growth in a deformable body based on the thermodynamics of irreversible material damage accumulation. Closed-form solutions for plastic, creep and fatigue damages, containing only known material parameters, were obtained under uniaxial conditions.</p> <p>Considering two sources of randomness that are independent of each other: spatial and temporal variations in the material microstructure, and randomness in the loading and external environment, and making use of the widely different time-scales between these two, a set of stochastic differential equations of damage growth were also derived.</p>

**4. The role of atomic scale defects:** Investigated the role of random defects and fluctuations at the nanoscale on the mechanical behaviour of crystalline as well as amorphous solids, the subject systems being carbon nanotubes (CNTs), ionic crystals, and functionalized CNTs in epoxy composites modeled with a combination of ab initio and molecular dynamics computations. Experimental work on synthesizing DNA-wrapped CNTs into FETs to be used as sensors of physical parameters such as relative humidity and heavy metals successfully demonstrated.

Fracture toughness of CNTs: the problem of unstable crack growth in CNTs at finite temperature was circumvented by computing the strain energy release rate through a series of displacement-controlled tensile loading of single walled carbon nanotubes (SWNTs) with pre-existing crack-like defects of various lengths. The critical strain energy release rate,  $G_c$ , was determined as a function of crack length for each tube at different temperatures. A significant dependence of  $G_c$  on crack length was observed, evoking the rising  $R$  curve behaviour of metals at the macroscale, and suggesting that lattice trapping effect plays the role of crack tip plasticity at the atomic scale.

Effect of randomness: Modeled Stone-Wales (SW) defects on CNT walls as a Matern hard core random field, and studied randomness in load deformation histories, rate dependence, elasticity and fracture properties of CNTs.

Size effects: Investigated the compliance and ultimate strength of the CNT as their length was increased keeping the SW occurrence rate constant. The compliance (bulk property) and the ultimate strength (extreme) were found to become asymptotically independent. By analyzing the tube strength as a sequence of dependent stationary process, the extremal index was found which is likely to play an important role when longer and longer CNTs are adopted for practical applications.

**5. Structure property optimization:** Combined molecular dynamics and genetic algorithms on the “inverse problem” for the design of new materials through structure property optimization in the presence of multiple conflicting objectives.

**6. Safety of structural components:** Applied knowledge of material degradation, stochastic simulations, system reliability, extremal processes and risk assessment into structural engineering problems that have resulted in improved load modelling, damage detection, system identification, seismic reliability, disaster mitigation and developing design guides for prestressed members, nuclear power plant shells, ships, offshore vessels and aging bridges. His work on massively parallel GPU-based matrix inversion has shown for the first time that the time complexity scales as  $n$  which has far-reaching implications on solution of large engineering problems including structural analysis.

## PUBLICATION AND DISSEMINATION

### 1. Journal publications

#### A. In the area of nanomechanics

1) Patra, P. and Bhattacharya, B. "Performance comparison of ergodic and non-ergodic deterministic thermostats," in preparation
2) Prasad, MVD and Bhattacharya, B. "Phononic origins of friction in carbon nanotube oscillators," submitted September 2016
3) Patra, P. and Bhattacharya, B. "Zeroth law investigation on logarithmic thermostat," submitted August 2016
4) Patra, P. and Bhattacharya, B. "Equilibrium free energy differences at different temperatures from a single set of nonequilibrium transitions," <i>Physical Review E</i> , APS, accepted, October 2016.
5) Chandra, A., Patra, P and Bhattacharya, B. "Thermomechanical Buckling of Boron Nitride Nanotubes using Molecular Dynamics," <i>Materials Research Express</i> , IOP, vol. 3, no. 2, 2016
6) Prasad, MVD and Bhattacharya, B. "Phonon scattering dynamics of thermophoretic motion in carbon nanotube oscillators," <i>Nano Letters</i> , ACS, 16(4):2174-2180, 2016.
7) Patra, P. and Bhattacharya, B. "Heat pump without particle transport or external work on the medium achieved by differential thermostatting of the phase space," <i>Physical Review E</i> , vol. 93, no. 3. 2016.
8) Patra, P. and Bhattacharya, B. "An ergodic configurational thermostat using selective control of higher order temperatures," <i>Journal of Chemical Physics</i> , AIP, vol. 142, 194103, 2015
9) Chandra, A., Patra, P and Bhattacharya, B. "Thermal vibration characteristics of armchair Boron-Nitride Nanotubes," <i>Journal of Applied Physics</i> , AIP, 118, 234503, 2015.
10) Prasad, MVD and Bhattacharya, B. "Phonon wave-packet scattering and energy dissipation dynamics in carbon nanotube oscillators," <i>Journal of Applied Physics</i> , AIP, 118, 244906, 2015.
11) Patra, P., Melendez, M. and Bhattacharya, B., "Approximating the entire spectrum of nonequilibrium steady-state distributions using relative entropy: An application to thermal conduction," <i>Physical Review E</i> , vol. 92, 023304, 2015.
12) Prasad, MVD and Bhattacharya, B. "Buckling and post buckling characteristics of cantilevered singlewalled carbon nanotubes in bending," <i>International Journal of Nanoscience</i> , World Scientific, 14, 1550019 (2015)
13) Paul, A., Bhattacharya, B. and Bhattacharyya, T.K. "Selective detection of Hg (II) over Cd(II) and Pb(II) ions by DNA functionalized CNT network," <i>IEEE Sensors Journal</i> , vol.15, no.5, pp.2774-2779, May 2015
14) Paul, A., Bhattacharya, B. and Bhattacharyya, T.K. "Electric-field assisted desorption of water molecules in DNA functionalized CNT network" <i>IEEE Sensors Journal</i> , vol. 15, no. 5, pp. 2947 – 2950
15) Patra, P. and Bhattacharya, B. "Non-Ergodicity of Nose-Hoover chain thermostat in computationally achievable time," <i>Physical Review E</i> , 90, 043304, 2014

16) Patra, P. and Bhattacharya, B. "A deterministic thermostat for controlling temperature using all degrees of freedom," <i>Journal of Chemical Physics</i> , AIP, vol. 140, 064106, 2014.
17) Paul, A., Bhattacharya, B. and Bhattacharyya, T.K. "Fabrication and Performance of solution based micro-patterned DNA functionalized carbon nanotube network as humidity sensors," <i>IEEE Trans. Nanotechnology</i> , vol. 13, no. 2, pp. 335-342, 2014.
18) Pal, A., Agarwala, A., Raha, S. and Bhattacharya, B. "Performance metrics in a hybrid MPI-OpenMP based molecular dynamics simulation of nanoindentation," <i>Journal of Parallel and Distributed Computing</i> , Elsevier, vol. 74, no. 3, pp. 2203-2214, 2014
19) Paul, A; Pramanick, B; Bhattacharya, B and Bhattacharyya, T.K. "Deoxyribonucleic acid functionalized carbon nanotube network as humidity sensors," <i>IEEE Sensors Journal</i> , vol. 13, no. 5, 1806-1816, 2013.
20) Rajak, P., Ghosh, S., Bhattacharya, B. and Chakraborti, N. "Pareto-optimal Analysis of Zn-coated Fe in the Presence of Dislocations Using Genetic Algorithms," <i>Computational Materials Science</i> , Elsevier, vol. 62, pp. 266-271, 2012
21) Rajak, P., Tewary, U., Das, S., Bhattacharya, B. and Chakraborti, N. "Phases in the Zn-coated Fe Analyzed through an Evolutionary Meta-model and Multi-objective Genetic Algorithms," <i>Computational Materials Science</i> , vol. 50, no. 8, pp. 2502-2516. 2011.
22) Prasad, MVD and Bhattacharya, B. "Molecular dynamics simulations of carbon nanotube-based oscillators having topological defects," <i>International Journal of Nanoscience</i> , World Scientific. vol. 10, no. 1, pp. 1-5, 2011
23) Paul, A. and Bhattacharya, B. "DNA functionalized Carbon Nanotubes for non-biological applications," <i>Materials and Manufacturing Processes</i> , Taylor and Francis, vol. 25, pp. 891-908, 2010.
24) Bhattacharya, B., G.R. Dinesh Kumar, A. Agarwal, Şakir Erkoç, A. Singh, N. Chakraborti "Analyzing Fe-Zn system Using Molecular Dynamics, Evolutionary Neural Nets and Multi-objective Genetic Algorithms," <i>Computational Materials Science</i> , Elsevier, vol. 46, no. 4, pp. 821-827, 2009.
25) Sreevathsan, R., Bhattacharya, B., G. Dinesh Kumar, N Chakraborti. "Multi-objective Materials Design by Genetic Algorithms – Generalized for B1 and B2 Ionic Structures" <i>Journal of Computational and Theoretical Nanoscience</i> , American Scientific Publishers, vol. 6, no. 4, pp. 849-856, 2009.
26) Sreevathsan, R., Bhattacharya, B., Chakraborti, N. "Designing of Ionic Materials through Multi-Objective Genetic Algorithms," <i>Materials and Manufacturing Processes</i> , Taylor and Francis, vol. 24, no. 2, pp. 162-168, 2009.
27) Chakraborti, N., Sreevathsan, R., Ravichandran, J. and Bhattacharya, B. "Tailor-made material design: An evolutionary approach using multi-objective genetic algorithms." <i>Computational Materials Science</i> , Elsevier, vol. 45, pp. 1 – 7, 2009.
28) Lu, Q. and Bhattacharya, B. "Fracture resistance of zigzag single-walled carbon nanotubes," <i>Nanotechnology</i> , Institute of Physics, vol. 17, pp. 1323-1332, 2006.
29) Baidurya Bhattacharya and Qiang Lu, "The asymptotic properties of random strength and compliance of single-walled carbon nanotubes using atomistic simulation," <i>Journal of Statistical Mechanics: Theory and Experiment</i> , paper no. P06021, June 2006.
30) Lu, Q. and Bhattacharya, B. "Effect of randomly occurring Stone-Wales defects on mechanical properties of carbon nanotubes using atomistic simulation," <i>Nanotechnology</i> , Institute of Physics,

vol. 16, no. 4, pp. 555 – 566, 2005.
31) Lu, Q. and Bhattacharya, B. “The role of atomistic simulations in probing small-scale aspects of fracture – a case study in carbon nanotubes”, <i>Engineering Fracture Mechanics</i> , Elsevier, vol. 72, no. 13, pp. 2037-2071, 2005.
32) Bhattacharya, B. and Ellingwood, B. R. “Continuum damage mechanics analysis of fatigue crack initiation”, <i>International Journal of Fatigue</i> , vol. 20, no 9, pp. 631-639, 1998.
33) Bhattacharya, B. and Ellingwood, B. R. “A New CDM-based approach to structural deterioration”, <i>International Journal of Solids and Structures</i> , vol. 36, no. 12, pp. 1757-1779, 1999.
34) Bhattacharya, B. and Ellingwood, B. R. “A CDM analysis of stochastic ductile damage growth and reliability”, <i>Probabilistic Engineering Mechanics</i> , Elsevier, vol. 14, no 1-2, pp. 45-54, 1999
35) Bhattacharya, B. and Ellingwood, B.R. “Continuum damage mechanics-based model of stochastic damage growth”, <i>Journal of Engineering Mechanics</i> , ASCE, vol. 124, no. 9, pp. 1000-1009, September, 1998.

**B. In the area of probabilistic mechanics**

36) Sen, S. and Bhattacharya, B. “Non-Gaussian parameter estimation using generalized polynomial chaos expansion with extended Kalman filtering,” <i>Structural Safety</i> , Elsevier. Submitted May 2016.
37) Sen, S. and Bhattacharya, B. “Adaptive nonlinear Kalman filtering technique for parameter identification: an application to Bouc-Wen model,” <i>Journal of Civil Structural Health Monitoring</i> , Springer, submitted March 2016
38) Sen, S. and Bhattacharya, B. “Online structural damage identification technique using constrained dual extended Kalman filter,” <i>Structural Control and Health Monitoring</i> , Wiley, submitted May 2015. In revision.
39) Sen, S. and Bhattacharya, B. “Progressive damage identification using dual extended Kalman filter,” <i>Acta Mechanica</i> , Springer. Vol. 227, no. 8, pp 2099-2109. 2016.
40) Sen, S. and Bhattacharya, B. “A non-iterative structural damage identification methodology using eigenstructure assignment in state space,” <i>Structure and Infrastructure Engineering</i> , Taylor and Francis, DOI: 10.1080/15732479.2016.1157825. 2016.
41) Sen, S. and Bhattacharya, B. "Non-iterative eigenstructure assignment technique for finite element model updating," <i>Journal of Civil Structural Health Monitoring</i> , Springer, vol. 5, no. 4, pp. 365-375, 2015
42) Sen, D and Bhattacharya, B. “On the Pareto optimality of variance reduction simulation techniques in structural reliability,” <i>Structural Safety</i> , Elsevier, vol. 53, pp. 57-74, 2015.
43) Vhanmane, S. and Bhattacharya, B. “Probabilistic modeling of random corrosion loss in ship plating based on incomplete in-situ data,” <i>Journal of Royal Statistical Society: Series C</i> , submitted July 2015.
44) Bhattacharya, B., Chatterjee, A., Agrawal, G., and Mondal, A. “Reliability-based partial safety factors for dual performance level design of prestressed inner containment shells in Indian nuclear power plants,” <i>Nuclear Engineering and Design</i> , Elsevier, vol. 256, pp. 188-201, 2013.
45) Sharma, G., Agarwala, A., and Bhattacharya, B. “A Fast Parallel Gauss Jordan Algorithm for Matrix Inversion using CUDA” <i>Computers &amp; Structures</i> , Elsevier, vol. 128, pp. 31-37, 2013.
46) Agrawal, G. and Bhattacharya, B. “Effect of relative failure consequences in reliability based dual

performance design," <i>Canadian Journal of Civil Engineering</i> , Canadian Society of Civil Engineering, vol. 38, no 11, pp. 1216-26, 2011
47) Patra, P. and Bhattacharya, B. "An assessment of IS codal provisions for the design of low rise steel moment frames through incremental dynamic analysis," <i>Bulletin of Earthquake Engineering</i> , Springer, vol. 9, no. 2, pp. 581-. 2011.
48) Vhanmane, S. and Bhattacharya, B. "Ultimate strength analysis of ship hull girder under random material and geometric properties," <i>Journal of Offshore Mechanics and Arctic Engineering</i> , ASME, vol. 133, no. 3. 2011.
49) Agrawal, G. and Bhattacharya, B. "Partial safety factor design of rectangular partially prestressed concrete beams in ultimate flexural limit state," <i>Journal of Structural Engineering</i> , SERC Madras, vol. 37, no. 4, pp. 263-273, 2010.
50) Bhattacharya, B., Lu, Q., and Zhong, J. "Reliability of Redundant Ductile Structures with Uncertain System Failure Criteria: a Study on a Highway Steel Girder Bridge," <i>Sadhana, Indian Academy of Sciences</i> , vol. 34, no. 6, pp. 903 – 921, 2009
51) Bhattacharya, B. "The Extremal Index and the Maximum of a Dependent Stationary Pulse Load Process Observed above a High Threshold," <i>Structural Safety</i> , Elsevier, vol. 30, no. 1, pp. 34 – 48, 2008.
52) Bhattacharya, B., Li, D., and Chajes, M. J. "Bridge rating in the presence of strength deterioration and correlation in load process," <i>Structure &amp; Infrastructure Engineering</i> , Taylor and Francis, vol. 4, no. 3 pages 237 – 249, 2008.
53) Vhanmane, S. and Bhattacharya, B. "Estimation of Ultimate Hull Girder Strength with Initial Imperfections," <i>Ship and Offshore Structures</i> , Taylor and Francis, vol. 3, no. 3, pp. 149-158, 2008.
54) Zhong, J. and Bhattacharya, B. "A system reliability based design equation for steel girder highway bridges," <i>Journal of Structural Engineering</i> , SERC, India. vol. 34, No. 4, pp. 284–290, 2007
55) Vhanmane, S. and Bhattacharya, B. "On improved analytical method for stress-strain relationship for plate elements under axial compressive load," <i>Ship and Offshore Structures</i> , Taylor and Francis, vol. 2, no 4, pp. 347-353, 2007.
56) Guzda, M., Bhattacharya, B. and Mertz, D. "Live Load Distribution on Highway Bridges using In-service Bridge Monitoring System," <i>Journal of Bridge Engineering</i> , ASCE, vol. 12, no. 1, pp. 130-134., 2007.
57) Bhattacharya, B., Li, D. and Chajes, M. J. "Load and Resistance Factor Rating Using Site Specific Data," <i>Transportation Research Record: Journal of the Transportation Research Board</i> CDROM series, CD 11-S, National Academies, Washington, D.C., pp. 143–151, 2005
58) Bhattacharya, B., Li, D., Chajes, M. J. and Hastings, J. "Reliability-based load and resistance factor rating using in-service data", <i>Journal of Bridge Engineering</i> , ASCE, vol. 10, no. 5, 2005
59) Bhattacharya, B. Basu, R. and Srinivasan, S. "A probabilistic model of flooding loads on transverse watertight bulkheads in the event of hull damage", <i>Journal of Ship Research</i> , Society of Naval Architects and Marine Engineers, vol. 49, no. 1, pp. 12 – 23, 2005
60) Bhattacharya, B., Ma, K.-t. and Basu, R. "Developing target reliabilities for novel structures: the case of the Mobile Offshore Base", <i>Marine Structures</i> , Elsevier, vol. 14, no. 1 – 2, pp. 37-58, 2001

### C. Miscellaneous

61) Misra, C., Bhattacharya, B. and Basu, A. "A new framework to preserve Tagore songs," <i>World Digital Libraries</i> , TERI Press, vol. 3, no.1, pp. 63-72, 2010.
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## 2. Conference Publications/Presentations (selected):

1) Patra, P. and Bhattacharya, B. "Equilibrium free energy differences at different temperatures from a single set of nonequilibrium transitions," Non-equilibrium Simulation Conference NESC16, Sheffield, UK, July 2016.
2) Patra, P. and Bhattacharya, B. "Ergodicity and linear response of thermostats for single degree of freedom systems: towards improved temperature control," ASCE Engineering Mechanics (EMI 2016) and Probabilistic Mechanics and Reliability Conference (PMC 2016), Nashville, May 2016.
3) Chandra, A., Patra, P. and Bhattacharya, B. "Effect of precompression on thermal vibration characteristics of Boron-Nitride Nanotubes," International Conference on Advances in Dynamics and Control, Durgapur, February 2016
4) Sen, S. and Bhattacharya, B. "Adaptive nonlinear Kalman filtering technique for parameter identification: an application to Bouc-Wen model," <i>ASCE EMI Conference on Mechanics for Civil Engineers Against Natural Hazards, EMI 2015</i> , Hong Kong, January 2015
5) Patra, PK and Bhattacharya, B. "Advantages of a deterministic thermostat utilizing the entire phase space over other thermostating techniques," <i>Sixth International Conference on Theoretical, Applied, Computational and Experimental Mechanics</i> , Kharagpur, India, December 2014
6) Patra, PK and Bhattacharya, B. "Non-Ergodicity of Nosé-Hoover Chain Dynamics," <i>Sixth International Conference on Theoretical, Applied, Computational and Experimental Mechanics</i> , Kharagpur, India, December 2014
7) Sen, S. and Bhattacharya, B. "Non-iterative eigenstructure assignment based finite element model updating of a Mindlin–Reissner plate in Duncan form of state space using ambient vibration response," <i>Sixth International Conference on Theoretical, Applied, Computational and Experimental Mechanics</i> , Kharagpur, India, December 2014
8) Sen, S. and Bhattacharya, B. "Identification of Bouc-Wen model parameters using Extended Kalman filter with adaptive process and measurement covariance matrices," <i>Sixth International Conference on Theoretical, Applied, Computational and Experimental Mechanics</i> , Kharagpur, India, December 2014
9) Prasad, MVD and Bhattacharya, B. "Carbon nanotube oscillators: Effect of small bending strain," <i>Sixth International Conference on Theoretical, Applied, Computational and Experimental Mechanics</i> , Kharagpur, India, December 2014
10) Prasad, MVD and Bhattacharya, B. "Energy dissipation and phononic friction in carbon nanotube oscillators," <i>Sixth International Conference on Theoretical, Applied, Computational and Experimental Mechanics</i> , Kharagpur, India, December 2014
11) Pal, A., Kanungo, B., Bhattacharya, B. "Interfacial properties in amine functionalized carbon nanotubes in epoxy composite through ab initio and molecular dynamics simulations," <i>22<sup>nd</sup> International Workshop on Computational Mechanics of Materials</i> , Baltimore, MD, September 2012
12) Sen, D., Bhattacharya, B., Manohar, C.S. "Reliability of bridge deck subject to random vehicular and seismic loads through subset simulations," <i>International Conference on Bridge Maintenance, Safety and Management</i> , Lake Como, Italy, July 2012.
13) Pal, A., Kanungo, B., Karnati, S., and Bhattacharya, B. "Interfacial strength in amine functionalized carbon nanotubes in epoxy composite through ab initio and molecular dynamics simulations," <i>11<sup>th</sup> ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability</i> , Notre Dame, IN, June 2012
14) Sen, D. and Bhattacharya, B. "On the Pareto optimality of efficient simulation techniques in structural

reliability," <i>11<sup>th</sup> ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability</i> , Notre Dame, IN, June 2012
15) Vhanmane, SC and Bhattacharya, B. "Probabilistic modeling of ship corrosion based on incomplete in-situ data," <i>11<sup>th</sup> ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability</i> , Notre Dame, IN, June 2012
16) Bhattacharya, B. "Disaster mitigation of large infrastructure systems," <i>Proceedings of the International Symposium on Engineering under Uncertainty: Safety Assessment and Management (ISEUSAM 2012)</i> , Springer, Shibpur, India, January 2012.
17) Paul, A; Pramanick, B; Bhattacharya, B and Bhattacharyya, T.K; (2011) 'The effect of humidity on the electrical properties of DNA functionalized Carbon Nanotubes', International conference on Nanoscience and Nanotechnology, New Delhi, Dec 2011
18) Bhattacharya, B., Agrawal, G., Chatterjee, A. and Mondal, A. "Development of partial safety factors for the design of prestressed inner containment shells in Indian NPPs," <i>21<sup>st</sup> Conference on Structural Mechanics in Reactor Technology</i> , New Delhi, November 2011
19) Bhattacharya, B., Rajak, P., Tewary, U., Das, S., Chakraborti, N. "Multi-Objective Optimization of Energy Absorption and Shear Deformation Properties of Zinc-Coated Iron," <i>6<sup>th</sup> MIT Conference on Computational Fluid and Solid Mechanics</i> , Boston, June 2011
20) Chatterjee, A., Agrawal, G., Mondal, A. and Bhattacharya, B. "Development of partial safety factors for the design of partially prestressed rectangular sections in biaxial flexure," <i>4<sup>th</sup> Conference on Nuclear Reactor Technology</i> , Mumbai, March 2011.
21) Bhattacharya, B., Rajak, P., Tewary, U., Das, S. and Chakraborti, N. "Optimal Properties of Zn-coated Fe combining Molecular Dynamics, Evolutionary Meta-model and Multi-objective Genetic Algorithms." <i>XVIII Conference Computer Methods in Materials Technology</i> , Zakopane, Poland, January 2011
22) Vhanmane, SC and Bhattacharya, B. "Probabilistic evaluation of plate effectiveness in terms of effective width of attached plating," <i>International Conference on Marine Technology (MARTEC 2010)</i> , Dhaka, Bangladesh, pp. 255-264, Dec. 2010
23) Misra, C., Bhattacharya, B. and Basu, A. "A new framework to preserve Tagore songs," <i>International Conference on Digital Libraries</i> , New Delhi, February 2010.
24) Vhanmane, S. and Bhattacharya, B. "Ultimate strength of ship hull girder under random initial imperfections," <i>10<sup>th</sup> International Conference on Structural Safety and Reliability (ICOSSAR)</i> , Osaka, Japan, September 2009
25) Bhattacharya, B., Chajes, M. and Li, D. "Reliability-based optimized rating equation of deteriorating bridges using loading and corrosion data," <i>10<sup>th</sup> International Conference on Structural Safety and Reliability (ICOSSAR)</i> , Osaka, Japan, September 2009
26) Vhanmane, S. and Bhattacharya, B. "Ultimate strength analysis of ship hull girder under random material and geometric properties," <i>28<sup>th</sup> Int'l Offshore Mechanics and Arctic Engineering Conference (OMAE)</i> , Honolulu, USA, May 2009
27) Sreevathsan, R., Bhattacharya, B. and Chakraborty, N. "Design of ionic materials through multiobjective genetic algorithm," <i>Neural Networks and Genetic Algorithm in Materials Science</i> , Kolkata, India, January 8-10, 2008
28) Baidurya Bhattacharya, "The Extremal Index of a Dependent Stationary Pulse Load Process," <i>10<sup>th</sup> International Conference on Applications of Statistics and Probability in Civil Engineering (ICASP10)</i> , Tokyo, Japan, August 2007

29) Baidurya Bhattacharya and Qiang Lu, "The asymptotic properties of strength and compliance of single-walled carbon nanotubes containing random defects ," <i>10<sup>th</sup> International Conference on Applications of Statistics and Probability in Civil Engineering (ICASP10)</i> , Tokyo, Japan, August 2007
30) Michelle T. Bensi and Baidurya Bhattacharya, "Probability-based vulnerability and criticality assessment of a highway bridge subjected to terrorist attack," <i>10<sup>th</sup> International Conference on Applications of Statistics and Probability in Civil Engineering (ICASP10)</i> , Tokyo, Japan, August 2007
31) H. Suzuki, H. R. Riggs, M. Fujikubo, T. A. Shugar, H. Seto, Y. Yasuzawa, B. Bhattacharya, D. A. Hudson, H. Shin, "Very large floating structures," <i>Proceedings of the 26<sup>th</sup> International Conference on Offshore Mechanics and Arctic Engineering</i> , June 2007, San Diego, USA.
32) Baidurya Bhattacharya. "Reliability-based bridge rating using in-service loading data in the presence of corrosion deterioration," <i>Civil Engineering in the New Millennium</i> , Bengal Engineering and Science University, Shibpur, January 2007
33) Bensi, M., Bhattacharya, B. and Chajes, M. "Evaluating Risk of Terrorist Attack on a Cable Stayed Bridge: A Probabilistic Structural Analysis based Approach," <i>First International Conference on Safety and Security Engineering</i> , Rome, Italy, June 2005
34) B. Bhattacharya and Q. Lu "The asymptotic distribution of ultimate strength of single-walled carbon nanotubes using atomistic simulation," <i>Symposium on Stochastic Fatigue Fracture and Damage Mechanics, 9<sup>th</sup> International Conference on Structural Safety and Reliability</i> , Rome, Italy, June 2005.
35) Q. Lu and B. Bhattacharya. "Fracture resistance of single-walled carbon nanotubes through atomistic simulation," <i>9<sup>th</sup> International Conference on Structural Safety and Reliability</i> , Rome, Italy, June 2005.
36) Lu, Q. and Bhattacharya, B. "Analysis of Randomness in Mechanical Properties of Carbon Nanotubes through Atomistic Simulation," <i>46<sup>th</sup> AIAA/ ASME/ ASCE/ AHS/ ASC Structures, Structural Dynamics &amp; Materials Conference</i> , Austin, TX, April 2005
37) Bhattacharya, B. "Reliability of Nuclear Power Plant Piping Components Under Creep and Corrosion Damages" at the <i>2004 ASME International Mechanical Engineering Congress</i> , Anaheim, CA, Nov 2004
38) Lu, Q. and Bhattacharya, B. "Atomistic Simulation of Stochastic Aspects of Fracture in Carbon Nanotubes" at the <i>2004 ASME International Mechanical Engineering Congress</i> , Anaheim, CA, Nov 2004
39) Srinivasan, S. and Bhattacharya, B. "Probabilistic failure prediction of filament-wound glass-fiber reinforced composite tubes under biaxial loading," <i>9<sup>th</sup> ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability</i> , Albuquerque, NM, USA, July 2004.
40) Bhattacharya, B. and Lu, Q. "Atomistic simulation for studying the asymptotic behavior of ultimate strength of carbon nanotubes with randomly occurring defects," <i>9<sup>th</sup> ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability</i> , Albuquerque, NM, USA, July 2004.
41) Bhattacharya, B. Basu, R. and Srinivasan, S. "A probabilistic estimate of extreme value loads on transverse water tight bulkheads", <i>Proceedings of the 23<sup>rd</sup> International Conference on Offshore Mechanics and Arctic Engineering</i> , June 20-25, 2004, Vancouver, Canada
42) Lu, Q. and Bhattacharya, B. "A study of randomness in fracture of carbon nanotubes using atomistic simulation", <i>17<sup>th</sup> ASCE Engineering Mechanics Conference</i> , Newark, DE, June 2004
43) Stark, R. M., Shukla, D. K. and Bhattacharya, B. "On random vector analysis in mechanics problems", <i>17<sup>th</sup> ASCE Engineering Mechanics Conference</i> , Newark, DE, June 2004
44) Li, D., Bhattacharya, B. and Chajes, M. J. "Bridge in-service load & resistance factor rating method," <i>17<sup>th</sup> ASCE Engineering Mechanics Conference</i> , Newark, DE, June 2004

45) Lu, Q. and Bhattacharya, B. "A study of randomness in fracture using atomistic simulation," at the Symposium on Durability and Damage Tolerance of Heterogeneous Materials at the 2003 ASME International Mechanical Engineering Congress, Washington, DC, Nov 2003
46) Lu, Q. and Bhattacharya, B. "A Review of Recent Advances in Atomistic Simulations of Fracture" Structures Congress, Seattle, WA, May-June 2003
47) Chajes, M. , Bhattacharya, B., Attoh-Okine, N. and Hasting, J. "Application of Load and Resistance Factor Rating Using Site Specific Data", First International Conference on Bridge Maintenance, Safety and Management, Barcelona, Spain, July 2002.
48) Bhattacharya, B. "Asymptotic independence of material failure at different scales – the role of small-scale fluctuations", 15 <sup>th</sup> ASCE Engineering Mechanics Conference, New York, June 2002
49) Bhattacharya, B. "Random Fluctuations in Material Micro-structure: The Need for Space-Time Modeling", International Conference on the Advances in Civil Engineering, Kharagpur, India, January 2002
50) Basu, R. I. and Bhattacharya, B. "Challenges in the Application of System Reliability Principles to Floating Structures", 24 <sup>th</sup> Meeting of the United States Japan Natural Resources Marine Facilities Panel, Honolulu, Hawaii, November 2001
51) Bhattacharya, B. "Reliability of Nuclear Power Plant Components under Creep and Corrosion Damages", International Conference on Civil Engineering, Bangalore, India, July 2001
52) Pires, J.A., Sues, R.H., Cesare, M.A., Bhattacharya, B., Basu, R.I. and Sensharma, P. "Reliability Assessment of Watertight Ship Decks and Bulkheads", 8 <sup>th</sup> ASCE Specialty Conference on Probabilistic Mechanics and Structural Reliability, Notre Dame, Indiana, July 2000
53) Bhattacharya, B., Wang, S., Basu, R. and Ma, K-t. "Reliability-based combination of environmental parameters for the design of novel floating structures", 18 <sup>th</sup> Int'l Offshore Mechanics and Arctic Engineering Conf., St John's, Nfld, Canada, July 1999
54) Bhattacharya B, Ma K-T, Basu R. "Developing target reliability for novel structures: the case of the Mobile Offshore Base," Proceedings of the Third International Workshop on Very Large Floating Structures, Honolulu, Hawaii, 1999.
55) Ellingwood, B. R. and Bhattacharya, B. "Damage mechanics-based assessment of time-dependent structural deterioration and reliability", 26 <sup>th</sup> Water Reactor Safety Information Meeting, Washington, DC, Oct. 1998.
56) Bhattacharya, B. and Ellingwood, B. R. "Stochastic fatigue crack initiation based on continuum damage mechanics", Int'l Conference on Structural Safety and Reliability, Kyoto, Japan , Nov., 1997.
57) Ellingwood, B. R. and Bhattacharya, B. "Reliability-based condition assessment and service life prediction of steel containment and liners", Int'l Conf. on Structural Mechanics in Reactor Technology, Lyon, France, Aug., 1997
58) Bhattacharya, B. and Ellingwood, B. R. "A CDM-based Approach to Stochastic Damage Growth", 7 <sup>th</sup> ASCE Specialty Conf. on Probabilistic Mechanics, Worcester, Aug, 1996
59) Bhattacharya, B. and Ellingwood, B. R. "A Damage Mechanics-based Approach to Structural Deterioration", 11 <sup>th</sup> ASCE Engineering Mechanics Conf., Fort Lauderdale, May, 1996

### 3. Book chapters:

- |   |
|---|
| 1) Bhattacharya, B. "Risk and Reliability in Bridges," in <i>Innovative Bridge Design Handbook</i> , Ed. A. Pipinato, Elsevier. 2015. |
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### 4. Edited volumes:

- |  |
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| <i>Proceedings, 17<sup>th</sup> ASCE Engineering Mechanics Conference</i> , Eds: Kaliakin, V., Kirby, J., Yamamuro, J, Bhattacharya, B and Shenton, H. 2004. |
|--|

### 5. Reports (selected):

- |  |
|--|
| 1) <i>Very Large Floating Structures</i> , Report of Committee VI.2, 16 <sup>th</sup> International Ship and Offshore Structures Congress, 20-25 August 2006, Southampton, UK  |
| 2) <i>Reliability of Watertight Boundaries</i> , Advanced Analysis Department, American Bureau of Shipping, Houston, TX, 2000.   |
| 3) <i>Mobile Offshore Base Classification Guide</i> , (co-authored). Advanced Analysis Department, American Bureau of Shipping, Houston, TX, 1999.   |
| 4) Bhattacharya, B. and Ellingwood, B. R. <i>A Damage Mechanics Based Approach to Structural Deterioration and Reliability</i> , Report NUREG/CR-6546, US Nuclear Regulatory Commission, Washington, DC. 1997  |
| 5) Ellingwood, B. R., Bhattacharya, B. and Zheng, R-H. <i>Reliability-based Condition Assessment of Steel Containments and Liners</i> , Report NUREG/CR-5442, US Nuclear Regulatory Commission, Washington, DC. 1996                                     |
| 6) Ellingwood, B. R., Zheng, R-H. and Bhattacharya, B. <i>Reliability-based Condition Assessment of Steel Miter Gates</i> , Report submitted to Black & Veatch Engineers, Department of Civil Engineering, Johns Hopkins University, Baltimore, MD. 1996 |

### 6. Book reviews (selected):

- |  |
|--|
| 1) Bhattacharya, B. Review of Multiscale Simulation Methods for Nanomaterials, R.B. Ross and S. Mohanty (eds.), Wiley, 2008, in <i>Materials and Manufacturing Processes</i> , Taylor and Francis, 23: 893–894, 2008 |
| 2) Bhattacharya, B. Review of Carbon Materials and Nanotechnology, Anke Krueger Wiley, 2011, in <i>Materials and Manufacturing Processes</i> , Taylor and Francis, 27:580-81, 2012                                   |

## FUNDED RESEARCH

Career-wise: 25 Projects (3 ongoing, 22 completed) valued at Rs 365 lakh + USD 617,000

4 under consideration valued at Rs 225 lakh

Role and Title of Project	Project Type	Duration	Value	Agency	Status
1. co-PI. "Design of structures using the performance based earthquake engineering framework"	Research	3 years	Rs 24 L	BRNS	Under review
2. PI, "A Bayesian belief network based tool for real-time decision making in the event of severe damage to urban infrastructure"	Research	3 years	Rs 98 L	MHRD	Under review
3. PI, "First principles based investigation to understand and predict gas turbine material behaviour at the atomic scale"	Research	3 years	Rs 50 L	DRDO	Under review
4. PI, "Developing Advanced Facility for Research in Reliability Engineering"	Research	4/2015 – 3-2019	Rs. 50 L	BARC	Sanctioned
5. PI, "Development of constitutive equations for CNT epoxy nanocomposites"	Research	4/2015 – 3/2017	Rs. 20 L	ISRO	Ongoing
6. Co-PI, "Force identification in existing structures"	Research	12/2012 – 11/2019	Rs 35 L	DST	Ongoing
7. PI, "An exploratory investigation on the effect of uncertainties in in-service inspection of safety and life prediction of PFBR components"	Research	1/2015 – 12/2017	Rs 28 L	IGCAR	Ongoing
8. PI, "Advanced Facility for Research in Reliability Engineering"	Research	4/2009 – 3-2014	Rs. 150 L	BARC	Completed
9. PI. "A molecular mechanics investigation of the mechanical properties of amine functionalized CNT in epoxy matrix"	Research	9/2010 – 8/2012	Rs 30 L	ASL, DRDO, Hyderabad	Completed
10. PI, "A multi-scale investigation of the strength & durability of carbon nanotube based nano-electrode arrays used as bio-sensors"	Research	2/2009 – 2/2012	Rs 20 L	DBT	Completed
11. Co-PI, "Optimized properties of galvanized steel Phase 2"	Consultancy	6/2010 – 5/2011	Rs 5 L	Tata Steel	Completed
12. PI, "Swaralipi: a system for scripting Tagore's musical notes and transcoding,"	Research	10/2008 – 12/2011	Rs 10 L	Soc. Natural Language Tech. Research	Completed
13. PI, "Multi-scale modeling to study the role of atomic scale defects in CNT-based nanocomposites"	Research	9/2007 – 12/2010	Rs. 20 L	DST	Completed
14. co-I, "Development of suitable probability density functions for characterization of wave speed measurements in concrete"	Consultancy	12/2009 – 11/2010	Rs 2 L	CMERI Durgapur	Completed
15. PI, "Development of Life Prediction Technologies for Aeroengine Components"	Research	10/2007 – 9/2010	Rs 10 L	DMRL, DRDO	Completed
16. PI, "Development of reliability based criteria for containment design."	Consultancy	8/2008 - 8/2010	Rs 10 L	BARC	Completed
17. PI, "Simulation studies of mechanical behaviour and failure of carbon nanotubes"	Research	12/2006 – 6/2009	Rs. 10 L	DRDO	Completed

18. PI, "Multiscale modeling of small scale interfacial phenomena in carbon nanotube reinforced composites."	Research	6/2006 – 5/2009	Rs. 3 L	IIT Kgp	Completed
19. Co-PI, "Optimized properties of galvanized steel"	Consultancy	8/2008 – 2/2009	Rs 5 L	Tata Steel	Completed
20. PI, "Software capabilities for reliability analysis of ship structures"	Consultancy	5/2007 – 4/2008	Rs 4 L	Indian Register of Shipping	Completed
21. Co-Investigator, "Application of Load Resistance Factor Rating Using Site Specific Data"	Research	7/1/00 – 6/30/02.	\$47,828	Delaware Dept. of Transportation	Completed
22. PI, "The role of Small-Scale Fluctuations in Material Behavior and Failure"	Research	7/02 – 6/03	\$29,006	University of Delaware Research Foundation	Completed
23. Co-Investigator, "Development of Delaware's First Smart Bridge"	Research	09/01/02 – 08/31/04.	\$78,306	Delaware Dept. of Transportation	Completed
24. PI, Dean's startup fund College of Engineering	Research	2001-2006.	\$200,000	University of Delaware	Completed
25. PI, "Cracking of Overhead Sign Structures and Their Repair Using Composite Fabric as a Wrap"	Research	09/01/02 – 08/31/03.	\$10,954	Delaware Dept. of Transportation,	Completed
26. Co-Investigator, "Research Experiences for Undergraduates in Bridge Engineering"	Research	2002 – 2005	\$80,525/year	NSF	Completed
27. Co-Investigator, "Stainless Clad Rebar and CFRP Rehab Evaluation for Bridge 1-119,	Research	09/01/02 – 08/31/04.	\$59,140	Delaware Dept. of Transportation	Completed
28. Co-PI "Development of State-Specific Truck Weights"	Research	7/2004 – 7/2006	\$54,000	Delaware Dept. of Transportation	Completed
29. Co-PI "Assessing the Fatigue Life of Delaware's Steel Bridges"	Research	7/2004 – 7/2006	\$58,000	Delaware Dept. of Transportation	Completed



## TEACHING

### 1. Teaching post-graduate courses

- IIT Kharagpur (2006 – present)
  - *Applied Reliability Engineering*
  - *Probability based Design*
  - *Structural Reliability*
- Stanford University (2005)
  - *Probabilistic Models in Civil Engineering*
- University of Delaware (2000 – 2006)
  - *Probability Based Design* (including developing the course)
  - *Reliability of Engineering Systems* (including developing the course)
  - *Introduction to Emerging Methodologies for Engineering Analysis*
  - *Mechanical Behavior of Materials and Structures* (developed and taught jointly)
  -

### 2. Teaching under-graduate courses

- IIT Kharagpur (2006 – present)
  - *Solid Mechanics*
  - *Structural Analysis*
  - *Engineering Drawing and Graphics*
  - *Introduction to Civil Engineering and Materials*
- University of Delaware (2000 – 2006, 2016)
  - *Probability and Statistics for Engineers* (including developing the course)
  - *Solid Mechanics*
  - *Statics*

### 3. Teaching Assistant 1991 – 1996

- *The Johns Hopkins University, Baltimore, MD, USA*
  - TA in graduate courses: *Structural Reliability, Advanced Structural Analysis*
  - TA in undergraduate courses: *Steel Structures, Strength of Materials, Probability and Statistics, Engineering Graphics and Design*

### 4. Study Aids:

- 1) “Probability based Safety Assessment of Infrastructure Systems: Design, Maintenance and Safety Targets,” ISWT on Probabilistic Safety Assessment, IIT Kharagpur, December 2015. Available at [http://www.gian.iitkgp.ac.in/files/brochures/BR1447068216PSA\\_Brochure\\_Goyal.pdf](http://www.gian.iitkgp.ac.in/files/brochures/BR1447068216PSA_Brochure_Goyal.pdf)
- 2) “Structural Analysis,” Train 10 Thousand Teachers, National Mission on Education through ICT, IIT Kharagpur, September – October, 2015. Available at [http://www.nmeict.iitkgp.ernet.in/video\\_link.php?id=11%20&&%20vtype=mp4](http://www.nmeict.iitkgp.ernet.in/video_link.php?id=11%20&&%20vtype=mp4)
- 3) “Design philosophy,” Train 10 Thousand Teachers, National Mission on Education through ICT, IIT

Kharagpur, September – October, 2015. Available at  
[http://www.nmeict.iitkgp.ernet.in/video\\_link.php?id=11%20&&%20vtype=mp4](http://www.nmeict.iitkgp.ernet.in/video_link.php?id=11%20&&%20vtype=mp4)

- 4) “Design code development ,” Train 10 Thousand Teachers, National Mission on Education through ICT, IIT Kharagpur, September – October, 2015. Available at  
[http://www.nmeict.iitkgp.ernet.in/video\\_link.php?id=11%20&&%20vtype=mp4](http://www.nmeict.iitkgp.ernet.in/video_link.php?id=11%20&&%20vtype=mp4)
- 5) “Temperature control in molecular dynamics,” Pravartana. TEQIP Workshop on Mechanics and Applied Mathematics. July 2014. IIT Kanpur. Available at  
[http://www.iitk.ac.in/tkic/Pravartana14/Pravartan14\\_Videos.html](http://www.iitk.ac.in/tkic/Pravartana14/Pravartan14_Videos.html)

## 5. New courses proposed

*At University of Delaware (2001 – 2005)*

CIEG315 Probability and Statistics for Engineers (introductory course for 3<sup>rd</sup> year UG)

CIEG615 Probability based Design (intermediate course of 4<sup>th</sup> year UG and MS)

CIEG815 Reliability of Engineering Systems (advanced course for doctoral students)

MEEG667 Mechanical behaviour of materials and structures

*At IIT Kharagpur (2006-2016)*

CE60112 Risk and reliability analyses of civil infrastructure systems (for MTech students)

CE60103 Monte Carlo simulations in engineering (for MTech students)

CT70010 Nanomechanics (for doctoral students)

*GIAN 151001B04: Nonequilibrium Statistical Mechanics and Molecular Dynamics (co-taught with international and national experts, for country wide participation as part of Global Initiative of Academic Networks)*

## SUPERVISION OF STUDENTS

### • Doctoral students

- *Degang Li*. Ph.D. 2004. University of Delaware (co-advised). Thesis: “Reliability-based Load and Resistance Factor Rating of Bridges using Site Specific Data.”
- *Qiang Lu*. Ph.D. 2005. University of Delaware. Thesis: “Influence of randomly occurring defects on mechanical behavior of carbon nanotubes”
- *Suhas Vhanmane*, Ph.D. 2011. IIT Kharagpur. Thesis: “Probabilistic modeling of ultimate strength of ship structures under random initial imperfections and corrosion loss”
- *Ambarish Paul*. Ph.D. 2015. IIT Kharagpur (co-advised). Thesis: Solution processed and micro-patterned DNA functionalized carbon nanotube network as chemical sensors.
- *MVD Prasad*, Ph.D. 2016. IIT Kharagpur. Thesis: Phonostating and energy dissipation in CNT oscillators.
- *Puneet Patra*. Ph.D. Thesis: Identifying Temperature and Related Statistics for Nonequilibrium Steady States. Thesis submitted.
- *Subhamoy Sen*. Ph.D. 2016. Thesis: Control theory based structural health monitoring using ambient vibration response.

- **Masters students guidance: about 30**
- **Undergraduate interns/advises: about 40**

## INVITED TALKS

- 1) "Probability based Safety Assessment of Infrastructure Systems: Design, Maintenance and Safety Targets," *ISWT on Probabilistic Safety Assessment*, IIT Kharagpur, December 2015
- 2) "Phonon scattering dynamics of friction and thermophoretic motion in carbon nanotube oscillators," *Mathematics, mechanics and physics for tomorrow's materials*, International Centre for Mathematical Sciences, Edinburgh, October 2015
- 3) "Uncertainty in structural engineering," *2nd SRESA National Conference on Reliability and Safety Engineering*, Anna University, Chennai, October 2015
- 4) "Probability based design philosophy," *Train 10 Thousand Teachers, National Mission on Education through ICT*, IIT Kharagpur, September 2015
- 5) "Calibration of probability based design codes," *Train 10 Thousand Teachers, National Mission on Education through ICT*, IIT Kharagpur, September 2015
- 6) "Probability based design and assessment of civil infrastructure systems," SERC-CSIR, Chennai, August 2015
- 7) "Molecular dynamics simulation of thermal transport in carbon nanotubes," Annual Technical Meeting of NMD-ATM, College of Engineering Pune, Pune, Nov. 2014
- 8) "Temperature control in molecular dynamic simulations," *Pravartana*, IIT Kanpur, July 2014
- 9) "Risk and reliability issues in infrastructure management," *Indo Canadian Workshop on Sustainable Infrastructure Management Practices*, New Delhi, February 2014
- 10) "Treatment of uncertainty in structural engineering problems," *SERB-DST Brain Storming Workshop on Research in Structural Engineering*, Department of Civil Engineering, IISc, Bangalore, January 2014.
- 11) "Mechanical Properties of CNTs and CNT Nanocomposites Through Ab Initio and Atomistic Simulations," Dept. of Civil Engineering, Johns Hopkins University, Baltimore, MD, October 2012
- 12) "Strength and reliability assessment of structural components and systems," Boeing R&D Center, Bangalore, May 2012.
- 13) "Reliability assessment of structural components and systems," *Symposium on Fatigue Fracture and Integrity Assessment*, NML-Tata Steel, Jamshedpur, May 2012.
- 14) "Mechanical properties of CNTs and CNT epoxy interfaces through simulation studies," *Center for Development of Advanced Computing*, Govt. of India, Pune, April 2012.
- 15) "Challenges in disaster mitigation of large infrastructure by engineering design," *Indo American Frontiers of Engineering Symposium*, National Academy of Engineering, Washington, DC, March 2012
- 16) "Molecular dynamics simulation of fracture of carbon nanotubes," *Emerging Trends in Carbon nanotubes*, IIT Kanpur, November 2011
- 17) "Extreme Value Statistics for the Very Small and the Rather Large in Engineering Problems," Virginia Commonwealth University, Richmond, VA, July 2011

- 18) "Atomistic Simulations of Fracture," Institute of Mathematical Sciences, Chennai, February 2011.
- 19) "Atomistic Modeling of Fracture," University of Ljubljana, Slovenia, January 2011.
- 20) "Nanomechanics," Workshop on Materials Modelling and Simulation," University of Hyderabad, December 2010.
- 21) "Infrastructure Systems Reliability Involving non-Structural Components," *IUSSTF-NSF Indo-US Workshop on Innovative Materials & Structural Systems for Resilient & Sustainable Built Infrastructure*, IIT Bombay, Dec 2009
- 22) "Probability theory and Bayesian inference," *A short term course on logic and applications of logic*, IIT Kharagpur, December 2009
- 23) "Probability concepts," *Statistics & Pattern Recognition for Automated Diagnostics*, IIT Kharagpur October 2009
- 24) "Introduction to Partial Safety Factor in Engg. Design," *5th Indo-German Theme Meeting on 'Structural Integrity of Pressure Retaining Components'*, BARC and Jadavpur University, February, 2009
- 25) "Molecular dynamics simulation of fracture: a look at carbon nanotubes," *Indo US workshop on Materials Design: Measurement Modeling and Informatics*, Bengal Engineering and Science University, January 2009
- 26) "Molecular dynamics simulation of solids: a case study on carbon nanotubes," *AICTE/MHRD sponsored winter school on Nanoparticle-Science and Technology*, National Institute of Technology, Durgapur, Jan 2009
- 27) "Bending Behaviour of Carbon Nanotubes," Plenary Lecture, International Conference on Materials Discovery the *University of Tlemcen*, Oran, Algeria October 11 – 13, 2008.
- 28) "Probabilistic Background to FEMA Criteria for Steel Moment Frames," *A short term course on Seismic Reliability and Life Assessment of Structures*, National Programme on Earthquake Engineering Education (NPEEE), IIT Kharagpur, March 2007.
- 29) "Monte-Carlo Simulations in Engineering," *A short term course on Seismic Reliability and Life Assessment of Structures*, National Programme on Earthquake Engineering Education (NPEEE), IIT Kharagpur, March 2007
- 30) "Fracture and Fracture resistance of carbon nanotubes," *Workshop on Mechanical Behaviour of Systems at Small Length Scales -2*, IISc, Bangalore, February 2007.
- 31) "Monte Carlo Simulations in Engineering," *Soft Computing Tools in Civil Engineering*, IIT Kharagpur, November 2006
- 32) "Tensile properties and fracture resistance of single-walled carbon nanotubes through atomistic simulation," *Defence Materials Research Laboratory*, Hyderabad, May 2006
- 33) "Analysis of Randomness in Mechanical Properties of Carbon Nanotubes through Atomistic Simulation," *Indira Gandhi Center for Atomic Research*, Kalpakkam, May 2006
- 34) "Reliability of Redundant Ductile Structures with Uncertain System Failure Criteria," *Bhabha Atomic Research Center*, Mumbai, India, March 2006.
- 35) "Application of extreme value theory in civil engineering," *University of Ljubljana*, Slovenia, June 2005
- 36) "Issues in structural systems reliability," *Bhabha Atomic Research Center*, Mumbai, India, January 2005

- 37) "Atomistic Simulations of Fracture : A Review", *Indian Institute of Technology*, Kanpur, January 2003
- 38) "Reliability-Based Design: How to Use a Deterministic Finite Element Code in a Probabilistic World" *American Bureau of Shipping*, Houston, TX, November 2002.
- 39) "FORM Inverse FORM and Code Calibration", *Atomic Energy Regulatory Board*, Mumbai, India, August 2002.
- 40) "Selecting Target Reliabilities in Probability-Based Design", *Bhabha Atomic Research Center*, Mumbai, India, August 2002.
- 41) "Extreme Value Theory in Civil Engineering", *Indian Institute of Science*, Bangalore, August 2002
- 42) "The role of random nanoscale fluctuations in material damage growth and failure", *Oak Ridge National Laboratory*, Oak Ridge, TN, July 2002.
- 43) "Issues in Probability-based Design", *Bengal Engineering College*, India, August 2001.
- 44) "Stochastic CDM and Random Structural Damage Growth", *Rensselaer Polytechnic Institute*, Troy, NY, March 2000.
- 45) "Developing Target Reliability for Novel Structures: The Case of the Mobile Offshore Base", *Rice University*, Houston, TX, February 2000.
- 46) "Stochastic CDM and Random Fatigue Crack Initiation", *Stanford University*, Stanford, CA, January 1999

## PROFESSIONAL RECOGNITION

- **Member**, 2013 – present  
International Scientific Committee, International Conference on Structural Safety and Reliability, New York 2013, Vienna 2017
- **Visiting Faculty**, June 2012 – May 2013  
Department of Civil Engineering, Johns Hopkins University, Baltimore, MD, USA
- **Speaker, 2012 Indo-American Frontiers of Engineering Symposium**  
National Academy of Engineering, Washington, DC, March 2012
- **Member**, 2012 - 2016  
BRNS Expert Committee on Uncertainty & Sensitivity Analysis in Engineering & Environmental Systems
- **Associate Editor**, 2010- present  
ASCE Journal of Bridge Engineering
- **Adjunct Professor**, January 2010 – present  
Department of Civil and Environmental Engg., University of Delaware, Newark, DE, USA
- **Special Invitee**, 2010  
National Disaster Management Authority of India, Committee of Experts on Vulnerability Analysis and Risk Assessment, New Delhi
- **Visiting Assistant Professor** Autumn 2005  
Department of Civil and Environmental Engineering, Stanford University, Stanford, CA, USA
- **Member** May 2016 – present

- *ASCE Nanomechanics and Micromechanics Committee*
- **Member** June 2002 – present  
*ASCE Probabilistic Methods Committee*
- **Control Member**, October 2001 – present  
*ASCE Fatigue & Fracture Reliability Committee*
- **Member**, 2004 – present  
International Association for Structural Safety and Reliability (IASSAR), Subcommittee on Structural Reliability and Optimization (SC3)
- **Member**, 2006 -2009  
International Ship and Offshore Structures Congress, Committee I on “Loads”
- **Member** 2004 -2006  
International Ship and Offshore Structures Congress, Committee VI.2 on “Very Large Floating Structures”
- **Member** *Standards and Criteria Working Group*, Mobile Offshore Base Program, Office of Naval Research, Washington, DC, USA, 1998 – 99

## PROFESSIONAL SERVICE

- Chairman, Civil Construction and Maintenance Section, IIT Kharagpur. October 2013 – present
- In-charge, Structural Engineering Section, Dept. of Civil Engineering, IIT Kharagpur, Autumn 2013
- Asst. Warden, B. C. Roy Hall, IIT Kharagpur, 2007 – 2009
- Faculty Advisor, Civil Engineering BTech and Dual Degree students, IIT Kharagpur, 2009-2013
- Advisor, Civil Engineering Society, IIT Kharagpur, 2008-09
- Member Accreditation Board of Engineering Teaching (ABET) Committee, Department of Civil and Environmental Engineering, University of Delaware, 2001 – 2005
- Faculty Advisor ASCE Students Chapter, University of Delaware, 2001 – 2005