

Cal Poly State University
Civil and Environmental Engineering Department 13-263
San Luis Obispo, CA, 93407-0353
Phone: (805) 756-7637

EDUCATION

Ph.D. – Civil Engineering, 2001-January 2007. (Emphasis: Computational Structural Mechanics)

University of Washington, Seattle, Washington, USA

Doctoral Dissertation: ***An analytical study of reinforced concrete beam-column joint behavior under seismic loading.***

M. Tech. – Ocean Engineering, 1999-2001, (Emphasis: Applied Mechanics)

Indian Institute of Technology, Kharagpur, India & Technische Universität, Darmstadt, Germany

Thesis: ***On the control of vortex excited vibrations of bundled conductors in overhead transmission lines.***

B.E. – Civil Engineering, 1994-1998, (Emphasis: Structural Engineering)

Bengal Engineering & Science University, Shibpur, West Bengal, India

CURRENT EMPLOYMENT

LECTURER in **CAL POLY SAN LUIS OBISPO** (Date Joined: Fall 2006).

PROFESSIONAL REGISTRATION

E.I.T (California) Registration # 130209

RESEARCH INTERESTS

Computational mechanics, Structural mechanics, Constitutive modeling, Finite element methods, Structural analysis and design (both Reinforced Concrete and Steel), Continuum mechanics, Damage mechanics, Fracture mechanics, Numerical methods, Composite structures, Parallel computing

RESEARCH EXPERIENCE

- *California Polytechnic State University, San Luis Obispo – Winter 2007 to present*
 - Working on a funded project for development of a new type of sandwich composite panels made from PVC foam and glass-fiber composite for naval use from the Office of Naval Research. Several experimental and analytical investigations for static, dynamic and blast loading are being investigated in the research.
 - Completed working on macroscopic force-based fiber-analogy modeling technique for various components of a reinforced concrete and steel building and bridge structures such as shear walls, coupling beams, reinforced concrete beams and columns along with connection regions.
 - Investigating the bending buckling interaction mechanism of piles in liquefiable soils along with faculties in Bristol University, UK.
 - Involved with American Concrete Institute committees on “Joints” and “Finite Element Modeling of Reinforced Concrete Structures” investigating mechanics and code provisions for headed reinforcement bars and concrete-reinforcing steel bond respectively.
 - Working on development of statistical models using logistic regressions, Bayesian modeling and support vector methods.
- *University of Washington – Fall 2001 to 2006*
 - Developed, Calibrated, Validated and Implemented a new joint super-element model along with associated hysteretic material models with damage, for modeling the inelastic behavior of reinforced concrete interior beam-column joints under seismic loading, in an open-source object-oriented software (OpenSees). Introduced *Pinching4*, *Bar-Slip* material models and *Beam-Column Joint* element models (<http://opensees.berkeley.edu/OpenSees/manuals/usermanual/index.html>).
 - Developed tools and recommendations for performance based seismic design of reinforced concrete beam-column joints using Strut-and-Tie models, by specifying limits for stresses in struts and nodal regions.
 - Developed simulation model for reinforced concrete beam-column joint subjected to seismic loading using a continuum formulation with damage plasticity material models.

- Developed a probabilistic model for failure initiation in reinforced concrete beam-column joints.
- Implemented a concrete material model (Popovics model) with degraded linear unloading/reloading stiffness, according to the works of Karsan-Jirsa, and a tensile strength with exponential decay in an open-source software, OpenSees. Introduced *Concrete04 material* model (<http://opensees.berkeley.edu/OpenSees/manuals/usermanual/index.html>).
- Van-Nuys Testbed Simulation – used state-of-art multi-component models, developed by various researchers, to simulate the earthquake response of an older reinforced concrete building frame in OpenSees platform. The results of the investigation contribute to modeling the uncertainty of intensity measure and engineering demand parameter relationships. (http://peer.berkeley.edu/year6/yr6_projects/ta3/3272002.html).
- Performed experimental investigation and numerical continuum based simulation of three-point bend tests on single edged notched beams to determine fracture energy for concrete.
- *Technische Universität, Darmstadt, Germany – May 2000 to Feb 2001*
 - Developed a numerical model for spacer dampers to control vortex excited Aeolian vibration of bundled conductors in overhead transmission lines.
- *Indian Institute of Technology, Kharagpur, India – August 1999 to May 2000 & Mar 2001 to August 2001*
 - Developed a software framework, in Fortran, for dynamic analysis of composite shell structures to simulate the dynamic response of a composite propeller in a torpedo. (Project funded by Indian Navy).

RESEARCH PROPOSALS SUBMITTED and FUNDED

- A novel model for sandwich panels in marine structures: face plate with shear keys. ---- **P.I.** --- **Funded by Office of Naval Research** --- Amount \$56,000; January 2008- January 2009. [ONR #N00014-07-1-1152].
- Modeling, analysis and design of structural components. --- **Funded by CalPoly San Luis Obispo Honors Program.** Amount \$5000 for Winter and Spring Quarter 2008.
- Influence of skew in shear loading distribution of skewed in plan concrete multi-cell box-girder bridges. ---- **P.I.** -- Funding Agency: CalTrans (submitted: Nov 9th 2007 and unfunded)
- Reduction of skin-core delamination from the core in the composite sandwich panels for naval structures. --- **P.I.** -- (Submitted: May 21st 2008 to Office of Naval Research).
- Segmental concrete pavements: an innovative, sustainable and efficient alternative to conventional concrete and/or asphalt pavements. --- **P.I.** – (Submitted: June 11th 2008 to Interlocking Concrete Pavement Institute)

REFERRED JOURNAL PUBLICATION

- Martin, J., Stanton, J., Mitra, N., and Lowes, L. N. (2007). “Experimental testing to determine concrete fracture energy using simple laboratory test setup.” *ACI Materials Journal*, 104(6), 575-584.
- Mitra, N., and Lowes, L.N. (2007). “Evaluation, calibration and verification of a reinforced concrete beam-column joint model.” *Journal of Structural Engineering ASCE*, 133(1), 105-120.
- Lowes, L. N., Altoontash, A., and Mitra, N. (2005). "Closure to "Modeling Reinforced Concrete Beam-Column Joints Subjected to Cyclic Loading" by Lowes, L.N. and Altoontash, A." *Journal of Structural Engineering ASCE*, 131(6), 993-994.
- Hagedorn, P., Mitra, N., and Hadulla, T. (2002). “Vortex-excited vibrations in bundled conductors: A mathematical model.” *Journal of Fluids and Structures*, 16(7), 843-854.

ORAL PRESENTATIONS & CONFERENCE PROCEEDINGS

- Mitra, N. (2008). “Uncertainty in analytical structural response associated with high level modeling decisions” *Accepted in 14th World Conference in Earthquake Engineering*, Beijing, China, (Paper no. 14-0110).
- Mitra, N., and Lowes, L.N. (2008). “Factors influencing analytical continuum simulation of three-point bend test of a concrete notched beam” *Accepted in 14th World Conference in Earthquake Engineering*, Beijing, China, (Paper no. 05-01-0175).
- Mitra, N. (2008). “Continuum model for RC interior beam-column connection regions” *Accepted in 14th World Conference in Earthquake Engineering*, Beijing, China, (Paper no. 14-0111).

- Bhattacharya, S., Dash, S.R., Mitra, N., Adhikari, S. and Blakeborough, A. (2008). “Investigation of bending-buckling interaction of piles in liquefiable soils” *Accepted in 14th World Conference in Earthquake Engineering*, Beijing, China, (Paper no. 04-02-0106).
- Mitra, N., Lowes, L. N. (2007). “A macroscopic model for beam-column joint regions” *Presented in ACI Spring Convention, April 22-26, 2007, To be published in ACI Structural Journal special conference*.
- Lowes, L.N., Mitra, N., Theiss, A. and Paspuleti, C. (2006). “Modeling nonductile RC components and application to the PEER Van-Nuys test-bed.” *8th National Conference in Earthquake Engineering*, San-Francisco, California, April 2006, Paper No. 1792.
- Mitra, N., and Lowes, L.N. (2006). “Modeling the behavior of reinforced concrete beam-column building joints subjected to earthquake loading.” *8th National Conference in Earthquake Engineering*, San-Francisco, California, April 2006, Paper No. 530.
- Mitra, N., and Lowes, L.N. (2004). “Evaluation and advancement of a reinforced concrete beam-column joint model.” *13th World Conference in Earthquake Engineering*, Vancouver, British Columbia, Canada, Paper No. 1001.
- Mitra, N., and Lowes, L.N. (2004). “Evaluation and advancement of a RC beam-column joint model.” *5th International Ph.D. Symposium in Civil Engineering*, Delft, The Netherlands, Eds. Walraven, J., Blaauwendraad, J., Scarpas, T., and Snijder, B., Balkema Publishers, 325-333.

PAPERS (JOURNALS and CONFERENCE PROCEEDINGS) UNDER REVIEW

- Mitra, N., Kasper, E. (2008). “Novel methodology to improve shear resistance of composite sandwich panels.” *In Composites Science and Technology* (under preparation)
- LaFave, J.M., Shin, M. and Mitra, N. (2008). “Behavior and design of reinforced concrete beam column connections with joint eccentricity”. *Submitted for review to Structures Congress 2009*.
- Kang, T.H.K., Mitra, N. and Shin, M. (2008). “Headed reinforcement applications for reinforced concrete beam-column connections”. *Submitted for review to Structures Congress 2009*.
- Kang, T.H.K., Shin, M., Mitra, N., Bonacci, J.F. (2008). “A Review of Reversed Cyclic Tests of Beam-Column Joints with Headed Reinforcement.” *In ACI Structural Journal* (submitted August 2008)
- Mitra, N. (2008). “Numerical modeling considerations which affect nonlinear finite element analysis of concrete structures subjected to seismic loading.” *In Electronic Journal of Structural Engineering*.
- Mitra, N. (2008). “Uncertainty in analytical modeling of reinforced concrete structures subjected to static pushover loading.” *In Engineering Structures*.
- Mitra, N., Lowes, L. N. (2008). “Strut-and-Tie method for seismic design of reinforced concrete beam-column joints.” *In ACI Structural Journal* (submitted February 2008, currently in revision).
- Mitra, N., Mitra, S., and Lowes, L. N. (2008). “Probabilistic model for failure initiation of reinforced concrete interior beam column joints.” *In Structural Engineering and Mechanics* (submitted January 2008).

REPORTS TO SPONSOR

- Lowes, L.N., Mitra, N., and Altoontash, A. (2004). “A beam-column joint model for simulating the earthquake response of reinforced concrete frames.” *PEER Report 2003/10*, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, Berkeley

CONTRIBUTIONS to OPEN SOURCE PROGRAMMING

- Introduced *Shear-panel*, *Pinching4*, *Bar-Slip*, *Concrete04* material models and *Beam-Column Joint* element models in OpenSees environment (<http://opensees.berkeley.edu>)

AWARDS & RECOGNITION

- **Graduate Research Assistantship** in *University of Washington* (Fall 2001 – Summer 2006)
- **Travel Assistantship** (June 2004)
For oral presentation in *PhdCe5* symposium and attending an *Intensive course in Tensor Analysis for Constitutive modeling* in Delft, Netherlands.
- **Research Scholarship** in *Indian Institute of Technology, Kharagpur* (Spring & Summer 2001)
For development of a software framework for dynamic analysis of composite shell structures (project funded by Indian Navy for design of carbon composite propellers in torpedo).
- **Deutscher Akademischer Austausch Dienst (DAAD) Scholarship** (2000 – 2001)
Prestigious award from all over India in all different fields of Science & Engineering to do research work for Master's thesis in Germany.
- **Graduate Aptitude Test in Engineering (GATE) Scholarship** (1999 – 2001)
Awarded to a select few from thousands of students all over India for pursuing M.Tech. in Indian Institute of Technology.

INSTRUCTOR for Civil Engineering Courses at CAL POLY SAN LUIS OBISPO

- CE 355 (*Reinforced Concrete Design*)
- CE 207 (*Mechanics of Materials*)
- CE 351 (*Structural Analysis*)
- CE 259 (*Civil Engineering Materials*)

TEACHING ASSISTANT for Civil Engineering Courses at UNIVERSITY OF WASHINGTON

Activities included helping course-instructor with preparation of lessons and lectures, running discussion groups, answering student questions, occasionally making guest lectures, developing and grading homework and exams.

- CEE 220 (*Structural Mechanics*)
- CEE 504 (*Finite Elements*)
- CEE 457 (*Introductory Finite Elements*)
- CEE 454 (*Design of Timber Structures*)
- CEE 498 (*Matlab*)
- CEE 380 (*Elementary Structural Analysis and Design*)

PROFESSIONAL EXPERIENCE

- *RIBE Electroarmaturen, GMBH and Co., Germany – Research Trainee, Jan 2001-Feb 2001*
 - Train professional engineers on the use of a software (written by me for my Master's Project) for development of Stockbridge and Spacer-Dampers, which can be used for damping self-excited Aeolian vibration in Overhead transmission line cables, Guyed masts, Cable-stayed bridges.
- *Consulting Engineering Services (India) Ltd. – Structural Design Engineer, 1998- 1999*
 - Member of the building design team for National Stock Exchange of India Ltd, Exchange Plaza, Bandra-Kurla complex, Mumbai, India. The reinforced-concrete office building was built on a 10,000 sq. m area with 9 floors and 9 bays. Staad-III modeling and analysis was carried out for the entire building and it was designed as per Indian Code IS-456 and satisfied Indian seismic standards as per IS-1893. Apart from the normal beam-column and flat-slab constructions, interesting components of the building were the shear wall and vierendeel girders.
- *Stup Consultants Ltd, India. – Trainee Engineer, Summer 1997*
 - Member of a design team for coal storage silo designed as per German code.

PROFESSIONAL AFFILIATIONS

- Voting Member of *American Concrete Institute* (Committee 447, 352)
 - Sub-committee member on **Headed Reinforcement bars: application in Civil Engineering**
- Associate Member of *American Society of Civil Engineers*