

# Dr.NAVEET KAUR

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## SUMMARY

- Scientist at CSIR-Central Road Research Institute (CRRI)
- Rich experience in the area of piezoelectric energy harvesting during Ph.D. at IIT Delhi
- Secured 1<sup>st</sup> rank among all M.E Programs in Department of Civil Engineering at IIT Delhi
- Research areas of interest include piezo-electric energy harvesting (PEH), structural health monitoring (SHM), earthquake engineering, vibration control devices, bio-mechanics and concrete fatigue



## RESEARCH ACCOMPLISHMENTS

- Publications: 2 Book Chapters, 14 International Journal & 16 Int'l Conference (Annexure A) 2011-'18
- Invention Disclosure/Patent: A novel energy harvesting solution for reinforced concrete structure 2016
- Transfer of Technology (ToT) Agreement: Ph.D. Research resulted in ToT to the industry 2015
- Seminars & Lectures: Helped in organizing 4 workshops & delivered 8 lectures (Annexure B) 2010-'18
- Peer Review Activities: Review-board (a) Journal of Inst. of Smart Structures and Systems 2014  
(b) Construction and Building Materials (Elsevier) 2015  
(c) Sensors & Actuators: A. Physical (Elsevier) 2016  
(d) Journal of Testing and Evaluation (ASTM) 2016  
(e) Multidiscipline Modeling in Materials & Structures 2017

## EDUCATIONAL QUALIFICATION

### Indian Institute of Technology (IIT) Delhi, India

PhD in Structures: Completed in May, 2015 2011-'15

M.Tech. in Structures: 1<sup>st</sup> Rank out of 77 (CGPA: 9.3/10) 2008-'11

### Thapar University, Patiala India

B.E. in Civil Engineering: 5<sup>th</sup> Rank out of 27 (CGPA: 8.42/10) 2003-2007

## RESEARCH EXPERIENCE

**DST INSPIRE Faculty** (CSIR-Central Road Research Institute (CRRI), India) 2016-'17

*Project*: Structural Health Monitoring, Energy Harvesting and Piezoelectricity

**Post Doctorate** (The Hong Kong Polytechnic University, PolyU) 2015-'16

*Project*: Structural Condition Monitoring System for PolyU Smart Fish Bridge

**PhD** (Integrated SHM and energy harvesting using thin piezo patches in  $d_{31}$  mode) 2015

- Feasibility of same PZT patch in  $d_{31}$  mode for integrated SHM & PEH, circumventing secondary structures
- Analytical power estimation model for adhesively embedded/ surface bonded PZT patches
- Detailed numerical investigations for parametric study to maximize piezoelectric energy
- Demonstration of feasibility of combined energy harvesting & SHM on real-life steel/ RC bridges
- Determination of fatigue characteristics of concrete using PZT patches

**M.Tech.** (Structures) 2011

*Project 1*: Friction Dampers, High-Rise Buildings

- Investigation of earthquake response of medium to high-rise shear-type buildings with friction dampers
- Optimizing damping parameters by developing FORTRAN program based on Newmark's Beta method

*Project 2*: Investigation of Tuned Mass Damper in Base-Isolated Build'g under Near-Fault Earthquake 2011

**B. E.** (Analysis & Design of Industrial Structures) 2006

- Design of 80 m long tunnel for the Wagon Tippler Complex for Duro Felguera Industries, South Africa
- Analysis of 100 Mega Ton RCC silo using STAAD.Pro – 2005

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## R&D PROJECTS

### IIT Delhi

2014

- Project 1:* Experimentation for investigation of behaviour of UV coated cement fibre board under wind load  
*Project 2:* Contribution in employing low-cost impedance analyser for different structures using piezos  
*Project 3:* Experimental investigation, data analysis for excessive vibrations in ASF building, Gurgaon  
*Project 4:* Identifying cause and remedy measures for excessive vibrations in PNB building, Delhi

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## WORK EXPERIENCE

- **Engineer** (*Laing O'Rourke's, Eigen Tech. Services Pvt. Ltd., Gurgaon, India*) 2007-2008  
*Project 1:* Analysis & design of building using STAAD.Pro– 2007 for DLF project, Cyber City, Gurgaon  
*Project 2:* Analysis & design of underground water tanks, Extended Basement Area for Accenture, Gurgaon
- **Structural Engineer** (*Desein Pvt. Ltd., New Delhi*) 2008-2011  
*Project 1:* Reviewing of TG foundation & ID, PA fan foundation for 2×800 MW thermal power plant (TPP)  
*Project 2:* Analysis & design of cooling tower blow-down pump house for 2×507.5 MW TPP  
*Project 3:* Analysis & design of critical pipe supports framing plan & thrust block for CW piping line  
*Project 4:* Designed TG foundation, crane girder & low/high pressure heater beams for 2×250 MW TPP
- **Sr. Project Scientist** (*Indian Institute of Technology (IIT) Delhi*) 2015  
*Project 1:* Technical advice on building national Horticulture board  
*Project 2:* Experimental investigation of evaluation of UV coated cement fibre boards under wind load
- **Scientist** (*CSIR-Central Road Research Institute (CRRI), India*) 2017-Till Date  
*Project:* Structural Health Monitoring, Energy Harvesting and Piezoelectricity

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## AWARDS & RECOGNITIONS

- **INSPIRE Faculty:** Selected for prestigious 'INSPIRE Faculty Award' by DST, Govt. of India. 2016
- **NBCC Prize of Excellence:** For securing 1<sup>st</sup> rank (among 77) in Civil Engineering M.Tech. batch 2011
- **Best Oral Presentation:** Among all research scholars at IIT Delhi on Research Scholars' Day 2015
- **Who's Who in the World®:** Biography selected for inclusion in the Marquis 33<sup>rd</sup> Edition 2016
- **Guest Faculty, IGNOU:** Lecture broadcasted all over India on National Television, 'Gyan Darshan' 2014
- **Team Leader, Virtual Smart Structures Dynamic Lab:** Delivered video demonstrations for explaining the experiments; contributed in experiment improvement 2013-'14
- **Stanford Uni., USA:** 9<sup>th</sup> International Workshop on SHM (IWSHM-9) 2012
  - Delivered a talk on 'Feasibility of energy harvesting from piezo-patches in addition to SHM'
  - The video demonstration of my research work has been *selected among the 19 best across the world* for an event 'SHM in Action' in IWSHM-9, 12<sup>th</sup> September
- **Honoured as Guest Faculty, MHRD, Govt. of India sponsored QEEE Pilot Program** 2014
- **Won financial sponsorship for Asia Pacific Summer School:** Interacted and shared ideas with 50 international participants 2012
- **Presenter, UK India Educational & Research Initiative:** Presented my work at Bath University 2014
- **MHRD Scholarship:** Received Ministry of Human Resource & Development (MHRD) scholarship for Ph.D. 2011-'15
- **Winner, HELIX'05 (Inter-College Tech-Fest):** Technical paper presentation & bridge model making 2005
- **Rashtrapati Guide:** Highest award for Bharat Scouts & Guides awarded by President of India 2002

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## SOFTWARE SKILLS

STAAD Pro - 2008, COMSOL, SAP 2000, ANSYS, NISA, ABAQUS, MATLAB, FORTRAN

**ANNEXURE A**  
**LIST OF PUBLICATIONS**

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**CO-AUTHOR OF BOOK**

Bhalla, S., Suresh, R., Moharana, S. Visalakshi, T. and **Kaur N.** (2016) “Piezoelectric Materials: Applications in SHM, Energy Harvesting & Biomechanics”, **WILEY Publications**

- Chapter: Piezoelectric Energy Harvesting: Analytical Models
- Chapter: Energy Harvesting Using Thin PZT Patches on Real-Life Structures

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**INTERNATIONAL JOURNAL**

1. **Kaur, N.** and Bhalla, S. (2014), “Feasibility of Energy Harvesting from Thin Piezo Sensor Patches via Axial Strain Actuation Mode”, **Journal of Civil Structural Health Monitoring**, Vol. 4(1), pp 1-15.[[link](#)]
2. **Kaur, N.** and Bhalla, S. (2015), “Combined Energy Harvesting and Structural Health Monitoring Potential of Embedded Piezo Concrete Vibration Sensors”, **Journal of Energy Engineering, American Society of Civil Engineers (ASCE)**, Vol. 141(4), pp. 1-18. DOI: [10.1061/\(ASCE\)EY.1943-7897.0000224](https://doi.org/10.1061/(ASCE)EY.1943-7897.0000224). **Remained among top 3 ‘Most Read Article’** from Feb 2016 to Nov 2016
3. Suresh, R., Bhalla, S., Singh, C., **Kaur, N.**, Hao, J. and Anand, S. (2014), “Combined Application of FBG and PZT Sensors for Plantar Pressure Monitoring at Low And High Speed Walking”, **Technology and Health Care**, Vol. 23(1), pp. 47-61, DOI: [10.3233/THC-140867](https://doi.org/10.3233/THC-140867).
4. **Kaur, N.** and Bhalla, S. (2016), “Numerical Investigations on Energy Harvesting from Adhesively Bonded Thin PZT Patches in Surface Bonded/Embedded Configurations”, **Sensors and Actuators A: Physical**, Vol. 241, pp. 44-59. DOI: <http://dx.doi.org/10.1016/j.sna.2016.02.002>
5. **Kaur, N.**, Bhalla, S., Panigrahi, R. and Shanker, R. (2015), “Experimental evaluation of Miniature Impedance Chip for Structural Health Monitoring of Prototype Steel/RC Structures Based on EMI Technique”, **Experimental Techniques**, Vol. 40, No. 3 (May/ June), pp. 981-992. DOI: [10.1111/ext.12146](https://doi.org/10.1111/ext.12146)
6. **Kaur, N.**, Matsagar, V.A. and Nagpal, A.K. (2012), “Earthquake Response of Mid-Rise to High-Rise Buildings with Friction Dampers”, **International Journal of High-Rise Buildings, CTBUH**, Vol. 1(4), pp. 311-332. [[link](#)]
7. Negi, P., **Kaur N.**, Bhalla, S. and Chakraborty, T. (2015) “Experimental Strain Sensitivity Investigations on Embedded PZT Patches in Varying Orientations”, **The Indian Concrete Journal**, Vol. 89(1), pp. 87-90. (This paper was originally part of the Proceedings of Structural Engineering Convention, December 22-24<sup>th</sup>, 2014) [[link](#)]
8. **Kaur, N.**, Li, L., Bhalla, S., Xia, Y., Ni, P. and Adhikari, S. (2017) “Integration and Evaluation of Multiple Piezo Configurations for Optimal Health Monitoring of RC Structures”, **Journal of Intelligent Materials and Smart Structures**, Vol. 28(19), pp. 2717- 2736. [[Link](#)]
9. **Kaur, N.**, Li, L., Bhalla, S. and Xia, Y. (2017) “A Low-Cost Version of EMI Technique for Damage Detection In RC Structures using Multiple Piezo Configurations”, **Advances in Structural Engineering** Vol. 20(8), 1247- 1254 [[Link](#)]
10. Negi, P., Chakraborty, T., **Kaur, N.** and Bhalla, S. (2018) “Investigations on Effectiveness of embedded PZT patches at varying orientations for monitoring concrete hydration using EMI technique”, **Construction & Building Materials**, Vol. 169 (Apr), pp. 489-498. [[Link](#)]

11. S. Bhalla and **Kaur, N.** (2018) “Prognosis of Low-Strain Fatigue Induced Damage in RC Structures using Embedded Piezo-Transducers as Global cum Local Vibration Sensors”, **International Journal of Fatigue**,(Accepted on April 2, 2018).
12. **Kaur, N., Maddu,S.C.G. and Bhalla, S.** (2018) “Damage Detection, Retrofitting Assessment and Long Term Monitoring of Reinforced Concrete Structures using Embedded PZT Patches”, **Journal of Intelligent Materials and Smart Structures** (*Communicated*).
13. **Kaur N., Sahu, G.K., Lakshmy, P., Jay and Rana, R.** (2018) “Estimation of Loss of Post Tensioning Force in Reinforced Bridges”, **Journal of Bridge Engineering** (*under preparation*).
14. **Kaur, N., Singamsetty, S., Dasari, M. and Bhalla, S.** “New Paradigms in Energy Harvesting from Structural Vibrations and Wind using Piezo Transducers”, **Journal of Intelligent Materials and Smart Structures** (*under preparation*).

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## INTERNATIONAL CONFERENCE

1. Li, L., **Kaur, N.** and Xia, Y. (2016) “Integration of multiple piezo configurations for health monitoring of RC structures”, **7<sup>th</sup> Cross-Strait Workshop of Structural Monitoring and Control in Civil Engineering**, Department of Civil Engineering, National Taiwan University, 5<sup>th</sup>-8<sup>th</sup> July.
2. **Kaur, N.** and Balgavhar S., (2015)“Integrated Piezoelectric Energy Harvesting and Structural Health Monitoring for Transportation Infrastructure”, **6<sup>th</sup> International Conference on Power Electronics Systems and Applications (PESA)**, *Competition Paper*, December 15<sup>th</sup>-17<sup>th</sup>, The Hong Kong Polytechnic University, Hong Kong. [\[Link\]](#)
3. **Kaur, N.** and Bhalla, S. (2015) “Building smart infrastructure by combining shm and energy harvesting for a smart city”, **20<sup>th</sup> Annual Convention and National Seminar on Innovative Concepts in Making of Smart Cities, September 1<sup>st</sup> – 2<sup>nd</sup>**, **Indian Building Congress**, New Delhi, India, Vol. 22, No. 1, pp. 186-189.
4. Bhalla, S., Srivastava, S., Suresh, R., Moharana, S., **Kaur, N.** and Gupta, A. (2015), “Application of Structural Health Monitoring Technologies to Bio-Systems:Current Status and Path Forward”, **SPIE International Conference on Smart Structures NDE**, March 8<sup>th</sup>-12<sup>th</sup>, San Diego, California.
5. Bhalla, S., Suresh, R., Moharana, S., Visalakshi, T., **Kaur, N.** and Naskar, S. (2015), “Multi-Disciplinary Applications of Piezo-Sensors: Structural Health Monitoring, Bio-Mechanics And Energy Harvesting”, **SPIE International Conference on Smart Structures NDE**, March 8<sup>th</sup>-12<sup>th</sup>, San Diego, California.
6. **Kaur, N.** and Bhalla, S. (2014), “New Paradigms in Piezoelectric Energy Harvesting from Civil Structures”, **9<sup>th</sup> Biennial International Workshop on Structural Engineering Convention (SEC) 2014, Indian Association for Structural Engineering (IASE)**, December 20<sup>th</sup>-21<sup>st</sup>, IIT Delhi, India, pp. 2601-2614.DOI: [10.1007/978-81-322-2187-6\\_202](https://doi.org/10.1007/978-81-322-2187-6_202) [\[link\]](#)
7. Negi, P., **Kaur, N.,** Bhalla, S. and Chakraborty, T. (2014), “Experimental Strain Sensitivity Investigations on Embedded PZT Patches in varying orientations”, **9<sup>th</sup> Biennial International Workshop on Structural Engineering Convention (SEC) 2014, Indian Association for Structural Engineering (IASE)**, December 20<sup>th</sup>-21<sup>st</sup>, IIT Delhi, India, pp. 2615-2620.DOI: [10.1007/978-81-322-2187-6\\_127](https://doi.org/10.1007/978-81-322-2187-6_127) [\[link\]](#)

8. **Kaur, N.** and Bhalla, S. (2014), “Monitoring Strength Gain and Fatigue Damage of RC Structure Using Embedded PZT Sensors”, **7<sup>th</sup> ISSS International Conference on Smart Materials, Structures and Systems**, July 8<sup>th</sup>-11<sup>th</sup>, Indian Institute of Science (IISc.) Bangalore, India.
9. Singamsetty, S., **Kaur, N.**, and Bhalla, S. (2014), “Energy Harvesting from Structural Vibrations Using Piezo transducers: A Parametric Study”, **3<sup>rd</sup> International Conference on Sustainable Innovative Techniques In Architecture, Civil and Environmental Engineering (SITACEE - 2014) organized by "Krishi Sanskriti"**, April 26<sup>th</sup>-27<sup>th</sup>, Jawaharlal Nehru University, New Delhi, India, pp. 331-334. [[Link](#)]
10. **Kaur, K.**, Singmasetty, S., Dasari M. and Bhalla, S. (2014), “Piezoelectric Energy Harvesting Potential Through Built Up and Simple Configurations under Mechanical Vibrations”, **9<sup>th</sup> International Symposium on Advanced science and Technology in Experimental Mechanics (9th ISEM)**, November 1<sup>st</sup>-6<sup>th</sup>, Hotel Jaypee Siddharth, New Delhi, India.
11. Bhalla, S., **Kaur, N.**, Naskar, S. (2014), “Virtual Smart Structures and Dynamics Lab: Towards Teaching Advanced Concepts Online”, **9<sup>th</sup> International Symposium on Advanced science and Technology in Experimental Mechanics (9th ISEM)**, November 1<sup>st</sup>-6<sup>th</sup>, Hotel Jaypee Siddharth, New Delhi, India.
12. **Kaur, N.**, Bhalla, S., Gupta, N. and Jain, N. (2013), “Integrated Global Vibration and Low Cost EMI Technique for Structural Health Monitoring of RC Structures using Embedded PZT Patches”, **UK-India Education and Research Initiative, UKIERI Concrete Congress, Innovations in Concrete Construction**, March 5<sup>th</sup>-8<sup>th</sup>, NIT Jalandhar, Punjab, India, pp. 1620-1629.
13. **Kaur, N.** and Bhalla, S. (2013), “Feasibility for Energy Harvesting from Surface Bonded/Embedded Piezo-Patches in Addition to Structural Health Monitoring”, **9<sup>th</sup> IWSHM International Workshop on Structural Health Monitoring**, September 10<sup>th</sup>-12<sup>th</sup>, Stanford University, Stanford, CA – USA, pp. 2600-2605. [[link](#)]
14. Talakokula, V., Dhawan, S.K., Srivastava, S., **Kaur, N.**, Moharana, S., Bhalla, S., Bhattacharjee, B. and Gupta, A. (2013), “Recent Advances in Structural Health Monitoring based on EMI technique at IIT Delhi”, **International Conference on Trends and Challenges in Concrete Structures (TRACCS)**, December 19<sup>th</sup>-21<sup>st</sup>, CPWD Training Institute, Ghaziabad, UP, India.
15. **Kaur, N.**, Matsagar, V.A. and Nagpal, A.K. (2011), “Earthquake Response of Medium-Rise to High-Rise Buildings with Friction Dampers”, **18<sup>th</sup> ICSV International Congress on Sound and Vibration**, July 10<sup>th</sup>-14<sup>th</sup>, Rio de Janeiro, Brazil.
16. **Kaur, N.**, Matsagar, V.A. and Nagpal, A.K. (2011), “Tuned Mass Damper on Base-Isolated Building under Near-Fault Earthquakes”, **21<sup>st</sup>SMiRT International Conference on Structural Mechanics in Reactor Technology**, November 6<sup>th</sup>-11<sup>th</sup>, Indian Habitat Centre, New Delhi, India, pp. 2535-2542.

**ANNEXURE B**  
**SEMINARS AND INVITED LECTURES**

1. Participated and helped in organizing atwo-day **seminar** on “**Advances in Earthquake Engineering**”, IIT Delhi, 30<sup>th</sup> July, 2010 to 31<sup>st</sup> July, 2010.
2. Participated and helped in organizing**workshop** on “**Advances in Smart Materials and Structural Health Monitoring**”, IIT Delhi,December 12<sup>th</sup>, 2010.
3. Participated and helped in organizing**workshop** on “**Experimental Structural Dynamics, Health Monitoring and Non-Destructive Evaluation using Smart Materials**”, IIT Delhi, June 14<sup>th</sup>, 2013.
4. Participated and helped in organizing**workshop** on “**Advances in Corrosion in Concrete Structures- Science, Prevention and Repair**”, CSIR-CRRI, April 24<sup>th</sup>, 2017.
5. **Delivered a lecture** on “Structural Health Monitoring using Piezo Transducers: Introduction” at the Power Management Institute (PME), NTPC, Noida,October 6<sup>th</sup>, 2016.
6. **Delivered a lecture** on “Integrated Structural Health Monitoring and Energy Harvesting Potential of Piezo Patch” at the CSIR- Central Road Research Institute (CRRI), New Delhi,July 26<sup>th</sup>, 2016
7. **Delivered a lecture** on “Structural Health Monitoring using Piezo Transducers” at the Hong Kong Polytechnic University, Hong Kong,February 24<sup>th</sup>, 2016.
8. **Delivered a lecture** on “Integrated Structural Health Monitoring and Energy Harvesting Potential of Thin Piezo Patch” at IIT Delhi during Research Scholar’s Day, awarded for **Best Oral Presentation** among all research scholars at IIT Delhi, April 10<sup>th</sup>, 2015.
9. **Delivered a lecture** on “Introduction to Virtual Smart Structures and Dynamic Lab at IIT Delhi”, **The School of Engineering and Technology (SoET)-IGNOU, broadcasted on National Television Channel, ‘Gyan Darshan’, Indira Gandhi National Open University (IGNOU)**, April 20<sup>th</sup>, 2014.
10. **Delivered a lecture** on “Virtual Smart Structures and Dynamic Lab”, QEEE pilot program sponsored by **Ministry of Human Recourse and Development (MHRD), Govt. of India, IIT Delhi**, March 25<sup>th</sup>, 2014.
11. **Delivered a lecture** on “Integrated Structural Health Monitoring and Energy Harvesting from Thin Piezo Sensor Patch via Axial Strain Actuation Mode”, **Workshop** on *Quality Control of Concrete and Construction Materials Through Testing and Experimental Structural Dynamics, Structural Health Monitoring and Non-Destructive Evaluation using Smart Materials*, **IIT Delhi**, June 14<sup>th</sup>, 2013.
12. **Delivered a lecture** on “Integrated Structural Health Monitoring and Energy Harvesting from Thin Piezo Sensor Patch via Axial Strain Actuation Mode”, **Workshop** on *Experimental Structural Dynamics, Structural Health Monitoring and Non-Destructive Evaluation using Smart Materials*, **IETE, New Delhi**, October 26<sup>th</sup>, 2013.