SSDL

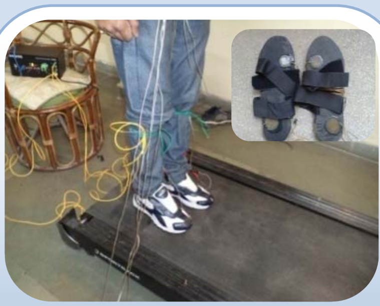
Smart Structures and Dynamics Laboratory

SMART STRUCTURES AND DYNAMICS LABORATORY

Indian Institute of Technology Delhi

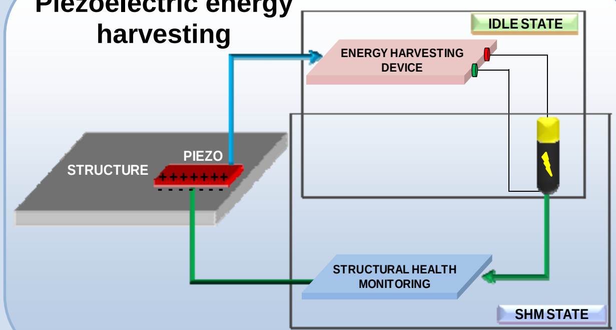
The ***Smart Structures and Dynamics Laboratory*** **(SSDL)** was founded in 2007 to establish dynamic measurement facilities based on smart materials and to develop new technologies to monitor the health of civil structures. SSDL is furnished with modern equipment such as dynamic signal acquisition systems, LCR meters, oscilloscopes, function generators, portable dynamic shaker and amplifier, accelerometers and many other cutting edge facilities. It uses accelerometers and piezoelectric ceramic (PZT) patches as dynamic response sensors, both in low and high frequencies. In addition, SSDL has a an operational ***Virtual Smart Structures and Dynamics Laboratory (VSSDL)*** component with specialised capability to facilitate remote triggered/ simulation based online experiments for engineering students at undergraduate and post graduate level.

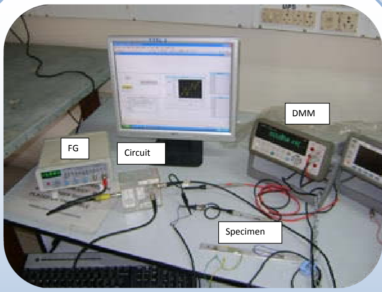
RESEARCH AREAS



New applications of smart materials in bio-mechanics

Piezoelectric energy harvesting



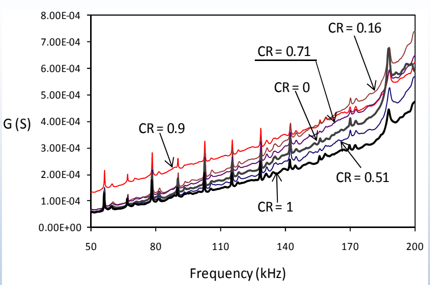


Development of low-cost SHM techniques

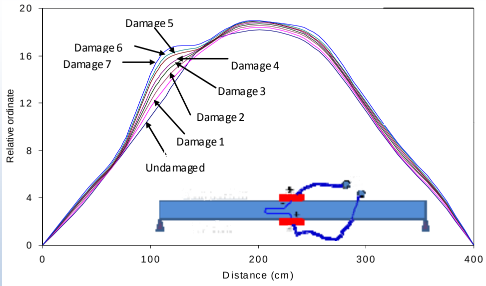
Development of new and effective dynamic response sensors

Rebar corrosion and structural durability assessment using piezo-sensors

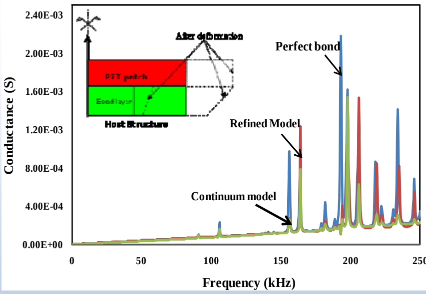
Multipurpose energy dissipation devices



Electro-mechanical impedance (EMI) technique



Structural Health Monitoring (SHM)

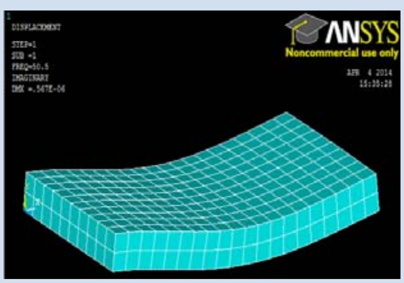


Piezo-structure bond elasto-dynamic modelling

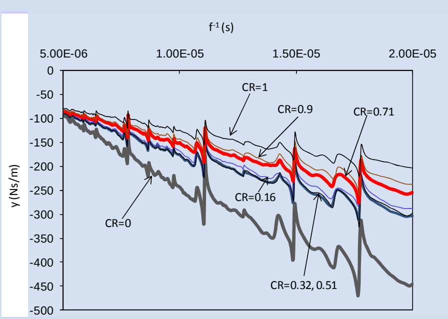
Monitoring of steel bolted joints under fatigue using EMI technique

Vibration testing of structures

Wind energy harvesting through piezo-sensors



Dynamic behaviour modelling using ANSYS



Parametric approach for monitoring fatigue damage

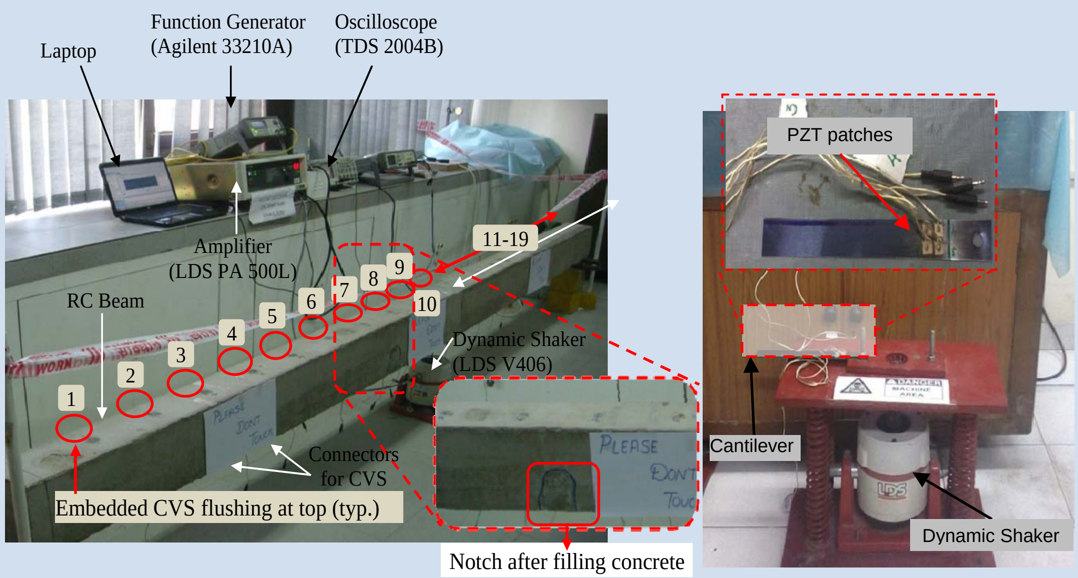
PROJECTS

SPONSORED R & D PROJECTS

S. No	TITLE	INVESTIGATORS	FUNDING AGENCY
1	Development of Low-cost Remote Health Monitoring System for Civil/ Mechanical/ Aerospace Structures Using Piezo-Ceramic Sensors	Dr. Suresh Bhalla Prof. Ashok Gupta	Armament R & D Establishment (DRDO)
2	Virtual Smart Structures and Dynamics Laboratory (Main Phase)	Dr. Suresh Bhalla	Ministry of Human Resource and Development
3	Experimental Investigations for Evaluation of UV Coated Cement Fibre Boards Under Wind Loads	Dr. Suresh Bhalla	Alstrong Enterprises (India) Pvt. Ltd.
4	Interactive Systems and Coatings for a Sustainable Built Environment	Dr. Suresh Bhalla Prof. M. Khare	UK India Education and Research Initiative (UKIERI)
5	Experimental Investigations on Glass Fibre Reinforced Cement Components	Dr. Suresh Bhalla Prof. B. Bhattacharjee	Lodhi Property Company Limited
6	Quality Enhancement in Engineering Education (Pilot Program)	Dr. Suresh Bhalla	Ministry of Human Resource and Development

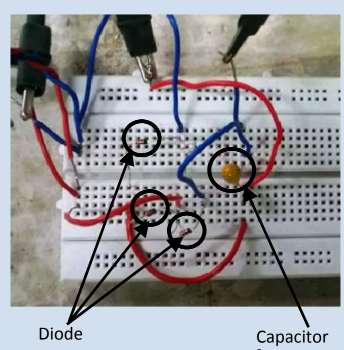
MAJOR CONSULTANCY PROJECTS

S. No	TITLE	INVESTIGATORS	FUNDING AGENCY
1	Investigations and Remedial Measures for Excessive Vibrations at King's Canyon Building	Dr. Suresh Bhalla	ASF Insignia SEZ Private Limited
2	Advice on Test Procedure for Evaluation of Friction Dampers	Dr. Suresh Bhalla Prof. Alok Madan	Uniforge Bearing Company Private Limited
3	Investigation and Remedial Measures for Excessive Vibrations in PNB Building at Parliament Street	Dr. Suresh Bhalla Prof. Alok Madan	Punjab National Bank
4	Seismic Qualification of Friction Dampers for Passive Structural Control of Skyscraper Buildings	Dr. Suresh Bhalla Prof. Alok Madan Prof. Ashok Gupta	Uniforge Bearing Company Private Limited
5	Load Testing of ESIC Hospital at Rohini	Dr. Suresh Bhalla Prof. Alok Madan	Hospitech Management Consultants Private Ltd
6	Finite Element Modeling and Stress Analysis of Cooling Water Duct in Thermal Power Plant.	Dr. Suresh Bhalla	Lanco Infratech Limited



Experimental studies related to piezo-electric energy harvesting

Low cost EMI technique using miniature impedance analyzer (AD5933)
(A low-cost alternative of conventional LCR meter)



Energy Harvesting Circuit

RECENT PUBLICATIONS

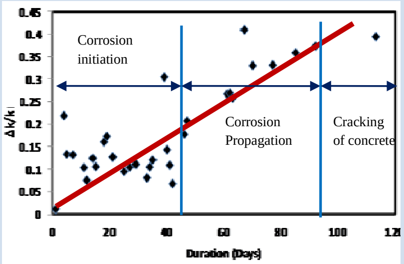
1.	Moharana, S. and Bhalla, S. (2015), "Influence of Adhesive Bond Layer on Power and Energy Efficiency of Piezo-Impedance Transducer", Journal of Intelligent Material Systems and Structures, Vol. 26, No. 3 (Feb), pp. 247-259.
2.	Kaur, N. and Bhalla, S. (2015), "Combined Energy Harvesting and Structural Health Monitoring Potential of Embedded Piezo-Concrete Vibration Sensors", Journal of Energy Engineering (ASCE), DOI: 10.1061/(ASCE)EY.1943-7897.0000224
3.	Suresh, R., Bhalla, S., Singh, C., Kaur, N., J. Hao and Anand, S. (2015) "Combined Application of FBG And PZT Sensors for Plantar Pressure Monitoring at Low and High Speed Walking", Technology and Health Care, Vol. 23, No. (Feb), pp. 47-61.
4.	Moharana, S. and Bhalla, S. (2014) "A Continuum Based Modelling Approach for Adhesively Bonded Piezo-Transducers for EMI Technique" International Journal of Solids and Structures, Vol. 51, No. 6 (Mar), pp. 1299-1310.
5.	Talakokula,V., Bhalla, S., and Gupta, A. (2014) "Corrosion Assessment of RC Structures Based on Equivalent Structural Parameters Using EMI Technique", Journal of Intelligent Material Systems and Structures, Vol. 25, No. 4 (Mar), pp. 484-500.
6.	Kaur, N. and Bhalla, S. (2014) "Feasibility of Energy Harvesting from Thin Piezo Patches via Axial Strain (d31) Actuation Mode", Journal of Civil Structural Health Monitoring, Vol. 4, No. 1 (Feb), pp. 1-15.
7.	Bhalla, S. and Suresh, R. (2013) "Condition Monitoring of Bones using Piezo-Transducers", Meccanica, Vol. 48, No. 9 (Nov), pp. 2233-2244.

RECENT WORKSHOPS

22 March 2014	WORKSHOP ON STRUCTURAL DYNAMICS: THEORY, EXPERIMENTS AND APPLICATIONS
07 December 2013	INTERNATIONAL WORKSHOP ON GREEN BUILDING AND SUSTAINABLE
26 October 2013	WORKSHOP ON EXPERIMENTAL DYNAMICS, STRUCTURAL HEALTH MONITORING AND NON-DESTRUCTIVE EVALUATION USING SMART MATERIALS
11 Sept 2013	WORKSHOP ON STRUCTURAL HEALTH MONITORING OF SUPERSTRUCTURES AND SUBSTRUCTURES THROUGH MODERN INSTRUMENTATION
14 June 2013 09 March 2013	WORKSHOP ON EXPERIMENTAL STRUCTURAL DYNAMICS, STRUCTURAL HEALTH MONITORING

Metal wire based variant of EMI technique

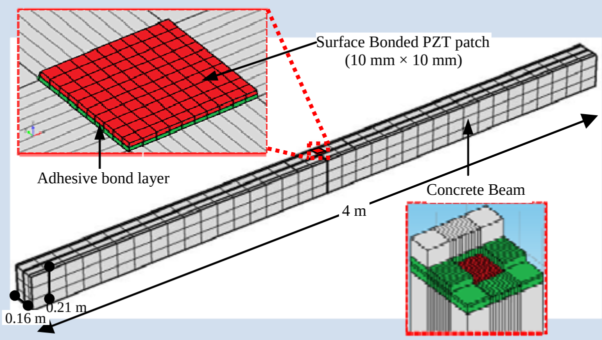
Bio-medical applications of piezo sensors



Predictive models for carbonation and chloride induced corrosion

Participants of the Workshop on Experimental Structural Dynamics, Structural Health Monitoring and Non-Destructive Evaluation, 9th March 2013

Virtual Smart Structures and Dynamics Lab (VSSDL)
Please visit http://ssdl.iitd.ac.in/vssdl/home.html for details



Simulation studies in COMSOL for piezoelectric energy harvesting based on surface-bonded and embedded PZT sensors

PEOPLE

FACULTY MEMBERS ASSOCIATED WITH LAB

- **Dr. Suresh Bhalla, Lab Mentor, Associate Professor, Civil Engineering Department**
- **Dr. Alok Madan, Professor, Civil Engineering Department**
- **Dr. B. Bhattacharjee, Professor, Civil Engineering Department**
- **Dr. Ashok Gupta, Professor, Civil Engineering Department**

DOCTORAL / M-TECH PROJECTS

S.NO	NAME	TITLE	GUIDE
		DOCTORAL PROJECTS COMPLETED	
1.	Dr. Ramakant Panigrahi	Development, Analysis and Monitoring of Dismountable Tensegrity Structures	Prof. A. Gupta, Dr. S. Bhalla
2.	Dr. Ramashanker	An Integrated Approach for Structural Health Monitoring	Dr. S. Bhalla, Prof. A. Gupta
3.	Dr. Sumedha Maharana	Modelling of Piezo-Structure Elastodynamic Interaction Through Bond Layer for Electro-Mechanical Impedence Technique	Dr. S. Bhalla
4.	Dr. T. Visalakshi	Corrosion Assessment in Rebars of RC Structures Using Equivalent Parameters Extracted from Piezo-Patches	Dr. S. Bhalla, Prof. A. Gupta
5.	Dr. Naveet Kaur	Integrated Structural Health Monitoring and Energy Harvesting from Thin Piezo Sensor Patch Via Axial Strain Actuation Mode	Dr. S. Bhalla
		DOCTORAL PROJECTS IN PROGRESS	
1.	Mr. Shashank Srivastava	Smart Materials in Bio-Sensing and Actuation	Dr. S. Bhalla, Prof. A. Gupta, Prof. A. Madan
2.	Er. S.K.Dhawan	Residual Life Prediction of Structures	Prof. B. Bhattacharjee, Dr. S. Bhalla
3.	Mr. Jashanjeet Randhawa	Structural Health Monitoring in the Absence of Baseline Data	Dr. S. Bhalla
4.	Ms Susmita Naskar	Structural Health Monitoring Using Piezo Sensors	Dr. S. Bhalla
5.	Mr. Sumit Balguvhar	Piezo-electric Energy Harvesting	Dr. S. Bhalla
6.	Mr. Mahesh Babu Adala	Structural Control of Building Frames Using Hybrid Control Devices Based on Energy Principles	Prof. A. Madan and Dr. S. Bhalla
		M-TECH PROJECTS COMPLETED IN 2015	
1.	Mr. Ajaya Kumar Das	Bio-Mechanical Application of Piezo-Materials	Dr. S. Bhalla
2.	Mr. Sailesh Adhikari	Structural Health Monitoring Using Piezo Sensors: Use of dual Piezo System	Dr. S. Bhalla
3.	Mr. Bharat Kumar Aggarwal	Wind Energy Harvesting Using Piezoelectric Transducers	Dr. S. Bhalla
4.	Mr. Rishi Kapoor	Analysis and Health Monitoring of Machine Foundations	Dr. S. Bhalla

Please visit http://web.iitd.ac.in/~sbhalla for details on other completed projects

SSD LAB TEAM

(L to R) **Mr. Sumit Balguvhar, Mr. Sailesh Adhikari, Mr. Sumit Dahiya, Ms Susmita Naskar, Dr Naveet Kaur, Dr Suresh Bhalla (Lab Mentor), Mr. Ajaya Kumar Das, Er. S K Dhawan Mr. Bharat Kumar Aggarwal, Mr. Arjun Jamil**

Dr. Suresh Bhalla (Lab Founder and Mentor)
Smart Structures and Dynamics Lab
Civil Engineering Department, Block-V, Room No. - 211
Indian Institute of Technology Delhi, India-110016
Phone: (+91)11-2659-1040, Email: sbhalla@civil.iitd.ac.in, Web: http://ssdl.iitd.ac.in