Dr. SUBHAMOY SEN

Assistant Professor,
Indian Institute of Technology Mandi

Education and work history

May 2017 - till date – **Assistant Professor** *at* School of Engineering, IIT Mandi, HP, India & Team Leader of *i*4S Laboratory, IIT Mandi

Nov 2016 - May 2017 – Post-doctoral fellow *at* I4S team, INRIA, Rennes, France.

2016 (June-August) – Post-doctoral fellow *at* IIT Bombay, SSRR Lab, Civil Engg. Dept.

2011–2016 – Ph.D. *from* IIT Kharagpur, Structural Engineering.

2010–2011– **DAAD Fellow**, Masters thesis *from* Technische Universität Darmstadt, Germany.

2009–2011– Masters of Technology *from* IIT Kharagpur, Specialized in Structural Engineering, 1^{st} Class Honours, Rank–1.

2008–2009– Management Trainee, *at* CESC Ltd., Kolkata

2004–2008– Bachelor of Engineering *from* IIEST Shibpur (Formerly BESU), Specialized in Civil Engineering, 1^{st} Class Honours.

Research Experience

Doctoral Thesis – ***Control theory based structural health monitoring using measured vibration response.***

The study employs control theory based techniques in health assessment of civil infrastructure systems. Eigenstructure assignment techniques, Kalman filtering and its nonlinear variants have been applied in this endeavor to deal model and measurement uncertainties affecting the identification process. Since the cost of instrumenting the structure as well as cost of computation is the major concern with traditional health monitoring algorithms, our study attempts to develop algorithms which are economical (both due to reduced instrumentation requirement and computation time) as well as precise in estimation.

Postdoctoral research – ***Development of robust and noise adaptive particle filtering based algorithm for structural health monitoring***

The study focuses on systems with correlated noise process undergoing change in environment of noise or force. The development targets introducing a particle filter based algorithm that can overcome the barriers. Developed algorithm considers correlation in noise processes which is eminent when Kalman like filtering techniques are employed for SHM purposes.

Awards

2009 – DAAD Scholarship awarded by Govt. of Germany.

2004 – Governor Gold Medal, awarded by Governor of West Bengal, India.

Publications

Journals

1. **Sen, S.**, Aswal, N., Zhang, Q, and Mevel, L., Structural health monitoring with nonlinear sensor measurements robust to unknown non-stationary input forcing, Conditionally accepted in **Mechanical System and Signal Processing**.
2. Sharma, S., **Sen, S.** One-dimensional convolutional neural network-based damage detection in structural joints. J Civil Struct Health Monit (2020). https://doi.org/10.1007/s13349-020-00434-z
3. **Sen, S**, Jianxun H, and K. S. Kasiviswanathan. Uncertainty quantification using the particle filter for non-stationary hydrological frequency analysis. **Journal of Hydrology** 584 (2020): 124666.
4. Sahagun, C, Jianxun He, Kasiviswanathan KS, **Sen, S.**,(201x) Stationary hydrological frequency analysis coupled with uncertainty assessment under nonstationary scenarios (Conditionally accepted in **Journal of Hydrology**)
5. Sharma, S., **Sen, S.**, Bridge damage detection in presence of varying temperature using two-step neural network approach (Conditionally accepted in **Journal of Bridge Engineering**)
6. **Sen, S.**, Crenerie, A., Cereu, F, Demoulin, J. and Mevel, L., Estimation of non-stationary noise processes in a damaged system through Correntropy based IPKF filter, **IFAC paper-sOnline**, Elsevier, vol–51(24) : 420–427 *doi: 10.1016/j.ifacol.2018.09.611*]

7. **Sen, S.**, Crenerie, A., Cereu, F, Demoulin, J. and Mevel, L., Detection of seismic induced damage through parallel estimation of force and parameter using improved interacting Particle-Kalman filter, **Mechanical Systems and Signal Processing**, Elsevier, vol–110 : 231–247 *doi:10.1016/j.ymssp.2018.03.016.*
8. **Sen, S.** and Bhattacharya, B., Non-Gaussian parameter estimation using generalized polynomial chaos expansion with extended Kalman filtering, **Structural safety**, Elsevier, vol–70 : 104–114 *doi: 10.1016/j.strusafe.2017.10.009.*
9. **Sen, S.** and Bhattacharya, B., Online structural damage identification technique using constrained dual extended Kalman filters, **Structural Control and Health Monitoring**, Wiley (2017), vol–24 (9): 1–12, *doi: 10.1002/stc.1961.*
10. **Sen, S.** and Bhattacharya, B., Progressive damage identification using dual extended Kalman filter, vol–227(8): 2099–2109, **Acta Mechanica**, Springer, *doi:10.1007%2Fs00707-016-1590-9.*
11. **Sen, S.** and Bhattacharya, B., A non-iterative structural damage identification methodology using eigenstructure assignment in state space, **Structure and Infrastructure Engineering**, Taylor & Francis (2017), vol–13(2), 211-222, *doi:10.1080/15732479.2016.1157825.*
12. **Sen, S.** and Bhattacharya, B., Non-iterative eigenstructure assignment technique for finite element model updating. **Journal of Civil Structural Health Monitoring**, Springer (2015), vol–5(4): 365–375, *doi: 10.1007/s13349-015-0107-x.*
13. Aswal, N., **Sen, S.** and Mevel, L, Robust filtering based health monitoring of tensegrity structures (In review)
14. Aswal, N., **Sen, S.** and Mevel, L, Input-robust strain based joint damage estimation by interacting Particle and Kalman filtering (In review)
15. Sharma, S., **Sen, S.**, Damage detection in composite plates under varying temperature through residual error modelling approach with dual neural network (Manuscript is under preparation)

Book Chapter

1. Aswal, N., **Sen, S.**, Design and Health Monitoring of Tensegrity Structures: An Overview, Book Chapter, Reliability, Safety and Hazard Assessment for Risk-Based Technologies, **Springer**, 2019.

Conferences

1. Sharma, S., **Sen, S.**, Damage detection in presence of varying temperature through residual error modelling approach with dual neural network, to be presented in EWSHM 2018 Conference, Manchester, UK.
2. Sharma, S., **Sen, S.**, Damage detection in presence of varying temperature using two stage neural network, to be presented in IMCE Conference 2018, Pittsburg, PA, USA.
3. **Sen, S.**, Crenerie, A., Cereu, F, Demoulin, J. and Mevel, L., Correntropy based IPKF filter for parameter estimation in presence of non-stationary noise process, to be presented in SAFEPROCESS 2018 (IFAC Conference), Poland.
4. **Sen, S.**, Crenerie, A., Cereu, F, Demoulin, J. and Mevel, L., Estimation of time varying system parameters from ambient response using improved Particle-Kalman filter, Apr 2017, European Geosciences Union, Vienna, Austria.
5. **Sen, S.**, Crenerie, A., Cereu, F, Demoulin, J. and Mevel, L., Seismic induced damage detection through parallel estimation of force and parameter using improved interacting Particle-Kalman filter, presented at IWSHM 2017, California, USA.
6. Hashmi, S., **Sen, S.** and Ghosh, S., Prediction of Flexural Buckling Strength of CFS Members with Local Geometric Imperfection using Stochastic Kriging, presented at ICOSSAR 2017, Vienna, Austria, 2017.
7. **Sen, S.** and Bhattacharya, B., Adaptive nonlinear Kalman filtering technique for parameter identification: an application to Bouc-Wen model, Engineering Mechanics Institute (EMI) International Conference of ASCE on Mechanics for Civil Engineers against Natural Hazards, Kwoloon, HongKong, China, January 2015.
8. **Sen, S.**, Radhika, B. and Bhattacharya, B., Identification of Bouc-Wen model parameters using Extended Kalman filter with adaptive process and measurement covariance matrices, Sixth ICTACEM, Kharagpur, India, December 2014.
9. **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, Sixth ICTACEM, Kharagpur, India, December 2014.

10. **Sen, S.** and Bhattacharya, B., Control theory based finite element model updating, International Conference on Computer Aided Engineering (CAE 2013), IIT Madaras.

Projects

1. **DST-Imprint 2**- Water and Energy Efficient Reliable Irrigation System (WatEr-ERIS): Solar energy and Cloud-based decision support systems for an automated irrigation system. (INR 9.4 million)
2. **DST-ECR**- Vibration based health monitoring of tensegrity structures incorporating the effects of ambient temperature. (INR 3.4 million)
3. **SEED-GRANT, IIT Mandi**, Robust health monitoring of steel bridges under varying environmental and traffic conditions: an application to Victoria bridge. (INR 0.93 million)
4. **ARDB Grant-in-aid**- Development of damage detection technique for composite laminated structures under varying temperature (INR 2.6 million)
5. **Chinese State S&T Grant** (Status- Decision awaited) -Damage identification of large bridges under varying operative and changing environment, with **Prof. Dongsheng Li**, Shantou University, China, and **Prof. Xia Yong**, HK PolyU, Hongkong. Submitted to Science and Technology Planning Project of Guangdong, China. (One million RMB)

Research Laboratory

Information and Statistics for Stochastic Structural Systems (*i*4S)
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Research Interests

Stochastic system identification; Structural health monitoring; Tesegrity Structures; Estimation of thermal parameters of materials; Effects of temperature load in structure; Flood prediction.

Computer skills

Languages – Matlab, Python, Mathematica, C.
Software – ABAQUS, Simulink, STAADpro.
Scripting – Latex, Visio.