Budhaditya Hazra

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Career summary

I am a well-known researcher in the area of blind source identification and signal separation. I have made seminal contributions towards developing blind signal separation as an effective tool for vibration analysis and successfully applied it to modal identification with a focus towards using minimal sensor information. I have eight years of research experience in all aspects of vibration engineering including modal analysis and testing, machine diagnostics, blind source separation, earthquake engineering, sensing and inspection technologies, statistical signal processing and soft computing techniques. I have over twenty scholarly publications and three patent applications to my credit. Currently, I am focusing on the application of the aforementioned techniques for condition monitoring and uncertainty quantification of vegetated slopes towards sustainable engineering.

Academic Information

- Ph.D. - University of Waterloo, Canada (2010)
- M.Tech- Indian Institute of Technology, Kanpur (2006)
- B.E. - Regional Engineering College Durgapur, West Bengal (2003)

Professional Experience

- Assistant Professor, Department of Civil Engineering, IIT Guwahati (Dec-2014 to date)
- Director of Research, SpectraQuestInc, Richmond, Virginia (Aug-2014 to Nov-2014)
- Post-Doctoral fellow, University of Waterloo, Canada (Oct-2012 to July-2014)
- Research Engineer, GE-Global Research, Bangalore, India, (March-2011 to Sept-2012)
- Post-Doctoral fellow, University of Waterloo, Canada (August-2010 to Feb-2011)
- Research Assistant, Department of Civil and Environmental Engineering, University of Waterloo, Canada (September 2006 to July 2010)
- Research Assistant, Department of Civil Engineering, IIT-Kanpur (Aug 2004-Aug 2006)

Teaching experience

- **Indian Institute of Technology Guwahati, Department of Civil Engineering**

  1) Reliability based structural design (CIVE 608); *winter 2015 and 2016.*
  2) Numerical methods (CIVE 601); *fall 2015 and 2016.*
  3) Statistical methods for civil engineers; *fall 2017.*

- **University of Waterloo, Department of Civil and Environmental Engineering**

  1) Structural Dynamics (CIVE 405); *winter 2013*.
  2) Structural Analysis (CIVE 303); *winter 2014.*

Publications(Cited: **377 times** as per google scholar)

Journal

1. **B.Hazra**, A.J.Roffel, S.Narasimhan and M.D.Pandey (2010), "Modified Cross Correlation Method for Blind Identification of Structures". *Journal of Engineering Mechanics, ASCE*, Vol-136(7).
2. **B.Hazra** and S.Narasimhan (2010), "Wavelet-based blind identification of the UCLA Factor building using ambient and earthquake responses". *Smart Materials and Structures*, IOP, Vol-19(2).
3. **B.Hazra,** A.Sadhu, R.Lourenco and S.Narasimhan, (2010), "Re-Tuning Tuned Mass Dampers Using Ambient Vibration Measurements". *Smart Materials and Structures*, IOP, Vol-19(11).
4. S.Shirali,**B.Hazra**,S.Narasimhan and M.D.Pandey (2009), "Independent component regression for predicting the responses of biaxial base-isolated buildings". *Earthquake Engineering and Structural Dynamics*, Wiley, Vol-39(5).
5. **B.Hazra**, A.Sadhu, A.J.Roffel, P.Paquet and S.Narasimhan (2010), "Under-determined Blind Identification of Structures using Modified Cross Correlation Method". *Journal of Engineering Mechanics, ASCE*, Vol-138(4).
6. **B.Hazra**, A.Sadhu, A.J.Roffel, and S.Narasimhan (2010), "Hybrid Time and Time-Frequency Blind Source Separation Towards Ambient System Identification of Structures". *Computer-Aided Civil and Infrastructure Engineering*, Wiley-Blackwell, Vol-27(5).
7. A.Sadhu, **B.Hazra**, S.Narasimhan and M.D.Pandey (2010), "Decentralized Modal Identification using Wavelet Transforms". *Smart Materials and Structures*, IOP, Vol-20(12).
8. A.Sadhu, **B.Hazra** and S.Narasimhan (2010), "Blind Identification of Earthquake-Excited Structures". *Smart Materials and Structures*, IOP, Vol-(4).
9. A.Sadhu and **B.Hazra** (2012), "A Novel Damage Detection Algorithm using Time-series Analysis-based Blind Source Separation" *Shock and Vibration*, IOS press, USA, doi: 10.3233/SAV-120759.
10. **B.Hazra** and A.Sadhu (2012), "Output-only de-tuning assessment of tuned mass dampers", *Journal of Civil Structural Health Monitoring*, Springer-Verlag, USA, doi: 10.1007/s13349-012-0031-2.
11. A.Sadhu, **B.Hazra** and S.Narasimhan (2012), "Ambient Modal Identification of Structures Equipped with Tuned Mass Dampers using Parallel Factor Blind Source Separation", *Smart Structures and Systems,*Techno press, Vol.13, No.2, pp.257-280.
12. A.Sadhu, **B.Hazra** and S.Narasimhan (2013). "Decentralized Modal Identification of Structures using Parallel Factor decomposition and Sparse Blind Source Separation", *Mechanical Systems and Signal Processing*, Vol. 41, issues 1-2, Elsevier.
13. **B.Hazra**, A.Sadhu and S.Narasimhan (2015), "Fault Detection of Gearboxes using Synchro-squeezing Transform", *Journal of Vibration and Control, 23(19), pp. 3108-3127.*

14. "Methods and systems to monitor health of rotor blades-I ". *United States Patent Application 20150184536*, Date of filing: Dec-12, 2013, Date of Publication: July-2, 2015.
15. "Methods and systems to monitor health of rotor blades-II ". *United States Patent Application 20150184533*, Date of filing: Dec-12, 2013, Date of Publication: July-2, 2015.
16. **B. Hazra**, A. Garg, V. Gadi and C.W.W. Ng (2016), "Probabilistic analysis of suction in homogeneously vegetated soils", *Catena*, Elsevier, Vol. 149, pp. 394-401.
17. Das, G., **Hazra, B.,** Garg, A., Ng, C.W.W., Lateh, H. and Avani, N. (2017)"Bivariate probabilistic modelling of hydro-mechanical properties of vegetated soil", *Advances in Civil Engineering Materials*, *ASTM*, 6(1), pp. 235-257.
18. Das, G., **Hazra, B.**, Garg, A., Ng, C.W.W (2017)."Impact of hydrological and mechanical correlations on the reliability of vegetated slopes", *ASCE-ASME Journal of Risk and Uncertainty Analysis*, ASCE, 3(4), pp. 04017029.
19. Krishnan, M., Bhowmik, B., Tiwari, A., **Hazra, B.**, (2017). "Online damage detection using Recursive Principal Component Analysis and Recursive Condition Indicators", *Smart Materials and Structures*, IOP, Vol. 26, No. 8, https://doi.org/10.1088/1361-665X/aa7220.
20. Prakash, A., **Hazra, B.**, Sreedeep, S, (2017)."Probabilistic analysis of water retention characteristic curve of fly ash", *International Journal of Geomechanics*, ASCE, 17 (12), https://doi.org/10.1061/(ASCE)GM.1943-5622.0001024.
21. Krishnan, M., Bhowmik, B., **Hazra, B.**, Pakrashi, V. (2017). " Real time damage detection using recursive principal components and time varying auto-regressive modeling", *Mechanical Systems and Signal Processing*, Elsevier, Vol.101, pp. 549-574.
22. Das, G., **Hazra, B.,** Garg, A. and Ng, C.W.W. (2017). "Stochastic hydro-mechanical stability of vegetated slopes: An integrated copula based framework", *Catena*, Elsevier, Vol. 160, pp. 124-133.
23. Goswami, U, P., Bhargav, K., **Hazra, B.,** and Goyal, M, K. (2017). "Spatiotemporal and joint probability behaviour of temperature extremes over the Himalayan region under changing climate", *Theoretical and Applied Climatology*, https://doi.org/10.1007/s00704-017-2288-1.
24. Das, S. and **Hazra, B.** (2017). "Frequency dependent principal component analysis of multi-component earthquake ground motions", *Earthquake Engineering and Structural Dynamics*, Wiley, https://doi.org/10.1002/eqe.3008

Conference

25. B.Hazra, S.Narasimhan and M.D.Pandey, "Stable Adaptive Control of Seismically Excited Nonlinear Structures". *Proceedings of SEI 2008 Structures Congress*, Vancouver, 2008.
26. B.Hazra, A.J.Roffel, S.Narasimhan and M.D.Pandey, "Blind identification of civil structures". *Proceedings of SEI 2009 Structures Congress*, Austin, April 2009.
27. B.Hazra and S.Narasimhan, "Wavelet-based blind identification of Civil Structures". *Proceedings of ASCE-ASME-SES Conference*, June 2009, Blacksburg, Virginia.
28. B.Hazra and S.Narasimhan, "Hybrid Time and Time-Frequency Blind Source Separation towards Ambient System Identification of Structures". *Proceedings of EMI-2010 (ASCE) Conference*, August-2010, USC, Los-Angeles.
29. B.Hazra and S.Narasimhan, "Re-Tuning of Tuned Mass Dampers Using Ambient Vibration Measurements", *Proceedings of EMI-2010 (ASCE) Conference*, August 2010, USC, Los-Angeles.

30. A.Sadhu, B.Hazra and S.Narasimhan, "Decentralized modal identification using wavelet transform", *Proceedings of EMI-2011 (ASCE) Conference*, June 2011, Boston, USA.
31. B.Hazra and S.Narasimhan, "Rotating machinery diagnosis using synchro-squeezing transform and condition indicators", *Proceedings of MFPT Conference-2013*, May 2013, Cleveland, Ohio, USA.
32. B.Hazra and S.Narasimhan, "Gear Fault Diagnosis using synchro-squeezing transform and condition indicators", *Key Engineering Materials*, Vols. 567-570 (2013), pp:449-456,Trans tech publications,Switzerland(DOI:10.4028/www.scientific.net/KEM.569-570.449).
33. B.Hazra, S.Pantula, S.Narasimhan, "Novelty detection in airport baggage conveyor gear-motors using Synchro-squeezing transform and Self-organizing maps", *Prognostics and Health Management Society Annual Conference-2013*, New Orleans, USA.
34. A.Sadhu, B.Hazra, "An Improved Blind Source Separation for Structural Mode Identification Using Fewer Measurements", Structural Health Monitoring and Damage Detection, Volume 7, *Proceedings of the Society for Experimental Mechanics Series 2015*, IMAC, Florida, USA. pp 19-25.
35. B. Hazra and S.Narasimhan (2016) "Gearbox Fault Detection using Synchro-squeezing Transform", *Procedia Engineering*, Elsevier, vol. 144, pp. 187-194.
36. Bhowmik, B., **Hazra, B.**, Pakrashi, V. (2017). "Online damage detection using recursive principal components", *Procedia Engineering*, Elsevier, vol. 199, pp. 2108-2113.

Patents

37. "Methods and systems to monitor health of rotor blades", *United States Patent*, No. 9657588, 2017.

Awards and Honors

1. International Doctoral Student Award, University of Waterloo, fall 2006 to spring 2009.
2. Special Graduate Student Entrance Award, University of Waterloo, winter 2007, 2010.
3. Graduate Student Fellowships, University of Waterloo, winter 2009 and fall 2009.
4. Merit Scholarships, R.E. College, Durgapur, India, 1999-2002.
5. Management award, GE Global Research, Bangalore, India, August & December 2011.
6. Henry and Sally Pusey 'Best Paper Award', MFPT Conference 2013, Cleveland, OH, USA.
7. Granted O-1 Visa by the government of United States of America, which is awarded to only a very select group of aliens of extraordinary ability.
8. Honoured as a valued reviewer of the journal of Mechanical Systems and Signal processing.

Research interests

- Blind modal identification
- Structural health monitoring
- Machine diagnostics and condition based maintenance
- Statistical signal processing
- Probabilistic modelling, uncertainty quantification and reliability
- Sustainable engineering, bio-engineered slopes and ecological engineering

Sponsored research projects

1.	**Title:** Development of a real-time low cost structural health monitoring system **Duration:**July 2015 – till date **Funding Agency:** IITG, Start-up Grant **Budget:**Rs 5, 00, 000 **Co-Investigator:** Nil **Major Outcomes:**Ongoing
2.	**Title:** Vibration based monitoring gearboxes in baggage handling system in Toronto Pearson International Airport. **Duration:** Oct 2012 –Nov-2013 **Funding Agency:** MITACS accelerate, Ontario, CANADA. **Budget: $45, 000 CAN** **Co-Investigator:**Dr. SriramNarasimhan **Major Outcomes: Completed**
3.	**Title:** Advanced signal processing algorithms for health monitoring of turbine blades. **Duration:**March 2011 – September 2012. **Funding Agency:**General Electric (GE) India Technology Centre **Budget:** **Co-Investigator:**GE internal **Major Outcomes:**Two patents accepted, currently a GE product.
4.	**Title:** Signal processing algorithms for detecting corrosion in pipes. **Duration:**March 2011 – September 2012. **Funding Agency:**General Electric (GE) India Technology Centre **Budget:** **Co-Investigator:**GE internal **Major Outcomes:**Passed two technological readiness levels
5.	**Title:** Blind Identification of modal parameters of Apron Control Tower located at Pearson International Airport in Toronto, based on full-scale measurement of ambient data. **Duration:**Fall 2009 to Fall 2012 **Funding Agency:**University of Waterloo, Fall 2009 **Budget:**$ 90, 000 CAN **Co-Investigator:**Dr. SriramNarasimhan **Major Outcomes:**Completed

References

Can be provided upon request