Subhayan De

Aerospace Engineering Sciences,
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OVERVIEW

Postdoctoral Associate, Former Viterbi Ph.D. Fellow, **Nationality:** Indian.

EDUCATION

Ph.D. in Civil Engineering May 2018
University of Southern California, Los Angeles
GPA: **4.0 out of 4.0**.
Thesis title: "A Novel Hybrid Probabilistic Framework for Model Validation" (awarded **best dissertation**).
Thesis advisor: Prof. Erik A. Johnson.
Co-advisor: Prof. Steven F. Wojtkiewicz.

M.S. in Electrical Engineering May 2016
University of Southern California, Los Angeles
GPA: **4.0 out of 4.0**.
Projects: *Structural system identification, model selection, and damage detection using wavelet approaches*, *Machine Learning for Musical Year Prediction.*

M.Eng. in Structural Engineering 2011-2013
Indian Institute of Science (IISc), Bangalore
GPA: **7.5 out of 8** (Rank: 1st).
Thesis title: *"Bayesian model selection in structural engineering"*.
Project: *Application of Multigrid Methods in Structural Mechanics Problems.*

B.Eng. in Civil Engineering with Honours 2007-2011
Jadavpur University, Kolkata
GPA: **9.28 out of 10** (Rank: 3rd).
Project: *Genetic Algorithm in Civil Engineering Applications.*

EXPERIENCE

University of Colorado, Boulder
Postdoctoral Associate June 2018 - present
Ann and H.J. Smead Department of Aerospace Engineering Sciences
University of Colorado, Boulder
Collaborators: Prof. Alireza Doostan and Prof. Kurt Maute
Lecturer for Random Vibrations Spring 2019
Ann and H.J. Smead Department of Aerospace Engineering Sciences
University of Colorado, Boulder

Visiting Scholar May 2018 - June 2018
Ann and H.J. Smead Department of Aerospace Engineering Sciences
University of Colorado, Boulder

University of Southern California

Graduate Research Assistant 2014, 2016-2017
Sonny Astani Department of Civil and Environmental Engineering
University of Southern California
Supervisor: Prof. Erik A. Johnson.

Viterbi Ph.D. Fellow 2013, 2015
Sonny Astani Department of Civil and Environmental Engineering
University of Southern California

Teaching Assistant for CE 225: Mechanics of Deformable Bodies Spring 2018
Sonny Astani Department of Civil and Environmental Engineering
University of Southern California

Teaching Assistant for CE 408: Risk Analysis in Civil Engineering Fall 2017
Sonny Astani Department of Civil and Environmental Engineering
University of Southern California

Teaching Assistant for CE 529a: Finite Element Analysis Summer 2017
Sonny Astani Department of Civil and Environmental Engineering
University of Southern California

Indian Institute of Science

Graduate Research Assistant 2012-2013
Department of Civil and Environmental Engineering
Indian Institute of Science
Supervisors: Prof. C. S. Manohar and Prof. Debraj Ghosh

JOURNAL PUBLICATIONS

Published/Accepted

1. **S. De**, S. F. Wojtkiewicz, and E. A. Johnson, "Computationally Efficient Optimal Design of Passive Control Devices for a Benchmark Cable-Stayed Bridge", *Structural Control and Health Monitoring*, (2017).

2. **S. De**, E. A. Johnson, S. F. Wojtkiewicz, and P. T. Brewick, "Computationally-Efficient Bayesian Model Selection for Locally Nonlinear Structural Dynamic Systems", *Journal of Engineering Mechanics* **(Editor's choice)**, (2018).

3. **S. De**, P. T. Brewick, E. A. Johnson, and S. F. Wojtkiewicz, "Investigation of Model Falsification using Error and Likelihood Bounds with Application to a Structural System", *Journal of Engineering Mechanics* **(Editor's choice)**, (2018).

4. **S. De**, P. T. Brewick, E. A. Johnson, and S. F. Wojtkiewicz, "A Probabilistic Hybrid Framework for Model Validation with Application to Structural Dynamics Modeling", *Mechanical Systems and Signal Processing*, (2019).

5. **S. De**, J. Hampton, K. Maute, and A. Doostan, "Topology Optimization under Uncertainty using a Stochastic Gradient-based Approach", *Structural and Multidisciplinary Optimization*, (2020).

6. **S. De**, K. Maute, and A. Doostan, "Bi-fidelity Stochastic Gradient Descent for Structural Optimization under Uncertainty", *Computational Mechanics*, (2020).

7. **S. De**, J. Britton, M. Reynolds, R. Skinner, K. Jansen, and A. Doostan, "Transfer Learning of Neural Networks using Bi-fidelity Data for Uncertainty Propagation", *International Journal for Uncertainty Quantification*, (2020).

8. **S. De**, "Uncertainty Quantification of Locally Nonlinear Dynamical Systems using Neural Networks", *ASCE Journal of Computing in Civil Engineering*, (accepted).

In review

9. **S. De**, B.S.M. Ebna Hai, and M. Bause, "Ultrasonic guided wave-based structural health monitoring under uncertainty using machine learning", *Computers & Structures*, (in review).

In preparation

10. **S. De**, and A. Doostan, "Neural Network Training for Uncertainty Propagation Using ℓ_1 Regularization and Bi-fidelity Data", *Journal TBD*, (in preparation).

11. **S. De**, K. Maute, and A. Doostan, "Topology Optimization under Microscale Uncertainty using Stochastic Gradients", *Journal TBD*, (in preparation).

12. **S. De**, K. Maute, and A. Doostan, "Reliability-based Topology Optimization under Uncertainty using Stochastic Gradients", *Journal TBD*, (in preparation).

CONFERENCE

1. **S. De**, M. Kamalzare, E. A. Johnson, and S. F. Wojtkiewicz, "Efficient Optimal Design of Passive Structural Control Devices for Complex Structures", *ASCE Engineering Mechanics Institute Conference, McMaster University, Hamilton, ON, Canada*, (2014).

2. **S. De**, M. Kamalzare, E. A. Johnson, and S. F. Wojtkiewicz, "Computationally Efficient Bayesian Model Selection for Structural Systems with Local Nonlinearities", *ASCE Engineering Mechanics Institute Conference, McMaster University, Hamilton, ON, Canada*, (Student Paper Competition Finalist) (2014).

3. **S. De**, S. F. Wojtkiewicz, and E. A. Johnson, "Efficient Optimal Design-Under-Uncertainty of Passive Structural Control Devices", *Proceedings of the 12th International Conference on Applications of Statistics and Probability in Civil Engineering (ICASP12), Vancouver, BC, Canada, T. Haukaas (Ed.)*, (2015).

4. **S. De**, E. A. Johnson, and S. F. Wojtkiewicz, "Fast Bayesian Model Selection with Application to Large Locally-Nonlinear Dynamic Systems", *6th International Conference on Advances in Experimental Structural Engineering, 11th International Workshop on Advanced Smart Materials and Smart Structures Technology, University of Illinois, Urbana-Champaign, IL, USA*, (2015).

5. **S. De**, E. A. Johnson, S. F. Wojtkiewicz, and P. T. Brewick, "Efficient Bayesian Model Selection for Locally Nonlinear Systems incorporating Dynamic Measurements", *10th International Workshop on Structural Health Monitoring (IWSHM)*, (2015).

6. **S. De**, P. T. Brewick, E. A. Johnson, and S. F. Wojtkiewicz, "Exploration of Error Rate Criteria to Decide Bounds for Model Falsification", *ASCE Engineering Mechanics Institute Conference, Vanderbilt University, Nashville, TN, USA*, (2016).

7. **S. De**, P. T. Brewick, E. A. Johnson, S. F. Wojtkiewicz, and I. Bermejo-Moreno, "Error and Likelihood Bounds for Falsification of Dynamical Models", *IMAC XXXV Conference, Hyatt Regency Orange County, CA, USA*, (2017).

8. **S. De**, E. A. Johnson, and S. F. Wojtkiewicz, "Efficient Uncertainty Quantification for Locally Nonlinear Dynamical Systems", *ASCE Engineering Mechanics Institute Conference, University of California, San Diego, CA, USA*, (Student Paper Competition Finalist) (2017).

9. **S. De**, P. T. Brewick, E. A. Johnson, and S. F. Wojtkiewicz, "Model Falsification in a Bayesian Framework", *ASCE Engineering Mechanics Institute Conference, University of California, San Diego, CA, USA*, (2017).

10. **S. De**, T. Yu, E. A. Johnson, and S. F. Wojtkiewicz, "Model Validation of a 4 Story Base Isolated Building using Seismic Shake-Table Experiments", *11th U.S. National Conference on Earthquake Engineering, Los Angeles, CA, USA*, (2018).

11. **S. De**, E. A. Johnson, and S. F. Wojtkiewicz, "Uncertainty Quantification of Locally Nonlinear Dynamical Systems using Polynomial Chaos Expansion", *SIAM Conference on Uncertainty Quantification (UQ18), Hyatt Regency Orange County, Garden Grove, CA, USA*, (2018).

12. **S. De**, A. Dasgupta, E. A. Johnson, and S. F. Wojtkiewicz, "Probabilistic Model Validation of Large-Scale Systems using Reduced Order Models", *SIAM Conference on Uncertainty Quantification (UQ18), Hyatt Regency Orange County, Garden Grove, California, USA*, (2018).

13. **S. De**, T. Yu, A. Dasgupta, E. A. Johnson, and S. F. Wojtkiewicz, "Probabilistic Model Validation of the Isolation layer of a Full-Scale Four-Story Base-Isolated Building", *ASCE Engineering Mechanics Institute Conference, Massachusetts Institute of Technology, Cambridge, MA, USA*, (2018).

14. A. Dasgupta, **S. De**, A. Dasgupta, E. A. Johnson, and S. F. Wojtkiewicz, "Probabilistic validation of material models", *ASCE Engineering Mechanics Institute Conference, Massachusetts Institute of Technology, Cambridge, MA, USA*, (2018).

15. **S. De**, K. Maute, and A. Doostan, "Topology Optimization under Uncertainty using Stochastic Gradients ", *Topology Optimization Roundtable, Albuquerque Marriot, Albuquerque, NM, USA*, (2019).

16. **S. De**, K. Maute, and A. Doostan, "Optimization under Uncertainty Using Stochastic Gradients", *15th U.S. Congress on Computational Mechanics, Austin, TX, USA*, (2019).

17. **S. De**, E. A. Johnson, and S. F. Wojtkiewicz, "Efficient Evidence Estimation for Bayesian Model Selection", *ASCE Engineering Mechanics Institute Conference, California Institute of Technology, Pasadena, CA, USA*, (2019).

18. A. Glaws, R. King, M. Reynolds, A. Doostan, and **S. De**, "Physics-informed Deep Learning for Multi-fidelity Uncertainty Quantification", *Workshop on Research Challenges and Opportunities at the interface of Machine Learning and Uncertainty Quantification, Los Angeles, CA, USA*, (2019).

19. **S. De**, J. Britton, M. Reynolds, and A. Doostan, "Neural Network Training using Bi-fidelity Data for Uncertainty Quantification", *SIAM Conference on Uncertainty Quantification (UQ20), Munich, Germany*, (canceled due to COVID-19 outbreak).

20. **S. De** and B.S.M. Ebna Hai, "Ultrasonic guided wave-based structural health monitoring system in fluid-solid and their interface: Physics-informed deep learning", *10th European Workshop on Structural Health Monitoring (EWSHM 2020), Palermo, Italy*, (postponed due to COVID-19 outbreak).

21. **S. De**, A. Doostan, "Multi-fidelity methods for deep neural network surrogates", *SIAM Conference on Computational Science and Engineering (CSE21), Fort Worth Convention Center, Fort Worth, Texas, USA*, (scheduled for 2021).

22. **S. De**, K. Maute, and A. Doostan, "Topology Optimization in the Presence of Microscale Uncertainty", *ASCE Engineering Mechanics Institute Conference, Columbia University, New York, USA*, (postponed to 2021).

RESEARCH PROPOSALS

- Assisted authoring CSD&E: *Collaborative Research: A New Framework for Computational Model Validation*, United States National Science Foundation, collaborative grants 16-63667 & 16-62992, September 2017 to August 2020, **$615,914** total (based on Ph.D. dissertation).
- Assisted authoring *Physics-Informed Deep Learning with Scientific Perceptual Loss Networks and Multifidelity Uncertainty Quantification*, accepted for funding by the United States Department of Energy, starts on January 2021, **$249,907**.
- Assisted authoring *Scalable and Multi-disciplinary Design Optimization of Hypersonic Systems* (submitted to the United States Air Force Office of Scientific Research for funding).

INVITED TALKS

- Faculty of Architecture, Civil Engineering and Environmental Sciences, Technische Universität Braunschweig, *Data-driven Modeling, Validation, and Design under Uncertainty*, July, 2020. (Webinar)
- Faculty of Mechanical Engineering, Helmut Schmidt University, *Dealing with Uncertainty in Modeling of Structures: Applications to Model Validation and Design Optimization*, April, 2020. (canceled due to COVID-19 outbreak)
- Department of Aerospace Engineering Sciences, University of Colorado, Boulder, *"Incorporating Uncertainty into Modeling: Applications to Model Validation and Design Optimization"*, November, 2019.
- Department of Civil Engineering, Indian Institute of Technology, Kanpur, *"Applications of Probabilistic Hybrid Model Validation Framework to Structural Problems"*, January, 2018.
- Department of Civil Engineering, Indian Institute of Science, Bangalore, *Probabilistic Hybrid Model Validation Framework*, December, 2017.
- Department of Civil and Environmental Engineering, University of Southern California, *Efficient Bayesian Model Selection for Locally Nonlinear Systems incorporating Dynamic Measurements*, March, 2015.

SYNERGISTIC ACTIVITIES

- **Organizing** a minisymposium on "Recent Advances in Design Optimization under Uncertainty" at the 16th U.S. Congress on Computational Mechanics, July, 2021.
- **Organized** and **chaired** a minisymposium on "Advances in Design Optimization under Uncertainty" at the 15th U.S. Congress on Computational Mechanics, July-August, 2019.
- **Chaired** a session on "Polynomial Chaos and Polynomial Approximation" at the SIAM Conference on Uncertainty Quantification (UQ18), Hyatt Regency Orange County, Garden Grove, California, USA, April, 2018.
- **Reviewer** for Structural Control and Health Monitoring, Computer Methods in Applied Mechanics and Engineering, ASCE Journal of Bridge Engineering, Computational Geosciences, AIAA journal, and International Journal for Uncertainty Quantification.

PROGRAMMING SKILL

MATLAB, C, Python, OpenFOAM

ACADEMIC BACKGROUND

Dynamics: Structural Dynamics, Finite Element Method in Dynamics, Random Vibrations and Structural Reliability.
Mathematics: Probability, Uncertainty Quantification, Ordinary Differential Equations, Optimization.
Signal Processing: Digital Signal Processing, Machine Learning, Wavelets.
Control Theory: Linear Feedback Control, Linear System Theory, Robust and Multivariable Control.

HONOURS & AWARDS

- Recipient of best dissertation award in Civil Engineering at University of Southern California, 2018.
- Recipient of Viterbi Graduate School Ph.D. Fellowship (2013-2017) and Gammel scholarship (Spring 2017) from University of Southern California.
- Recipient of Ministry of Human Resource Development, Govt. of India Scholarship for Graduate studies (August, 2011-July, 2013).
- Received travel grants from USC Graduate Student Government for attending *ASCE Engineering Mechanics Institute Conference*, 2014 & 2017, *IMAC XXXV Conference*, 2017.
- *ASCE Engineering Mechanics Institute Conference* Probabilistic Methods student paper competition finalist in 2014, 2017.
- Received scholarship from National Science Foundation to attend the Asia-Pacific Summer School on Smart Structures Technology, 2015.
- Selected as *Research Assistant of the month* in March 2015.
- GATE (Graduate Aptitude Test in Engineering) All India Rank: 5th in the year 2011 (Civil Engineering).
- University Medal from Jadavpur University, 2011.

ASSOCIATION MEMBERSHIPS

- The American Society of Civil Engineers (ASCE).
- The Society for Industrial and Applied Mathematics (SIAM).
- The United States Association for Computational Mechanics (USACM).

EXTRACURRICULAR ACTIVITIES

- Senior Diploma in Fine Arts with Distinction.
- Junior Diploma in Acoustic Hawaiian guitar with Distinction.
- Treasurer of Balaka: Bengali Association of USC in 2017.
- Organized a Bengali festival in campus for 2014-2016.