Somdatta Goswami

somdatta_goswami@brown.edu

170 Hope Street, Division of Applied Mathematics,
Brown University, Providence, RI 02906, U.S.A.

Work Experience

2022, Aug – Present
Assistant Professor (Research), Division of Applied Mathematics
Brown University, U.S.A.

2021, Jan – 2022, July
Postdoctoral Research Associate, Division of Applied Mathematics
Brown University, U.S.A.
Advisor: George Em Karniadakis
Deep learning, Physics driven machine learning

2013 – 2017
Assistant Manager, Tata Consulting Engineers Limited.

Education

2017 – 2020
Ph.D. in Civil Engineering, Bauhaus University Weimar, Germany
Advisor: Timon Rabczuk
Thesis title: *Phase field modeling of fracture with isogeometric analysis and machine learning methods*

2011 – 2013
M.E. in Structural Engineering, Indian Institute of Engineering Sciences and Technology, Shibpur, India.
Advisor: Subrata Chakraborty

2007 – 2011
B.E. in Civil Engineering, Birla Institute of Technology, Ranchi, India.

Research Publications

- Google Scholar
- All the codes are available at Github

Preprints

1. Chakraborty, A., Anitescu, C., **Goswami**, **S.**, Zhuang, X., & Rabczuk, T. (2022). *Variational energy based XPINNs for phase field analysis in brittle fracture*.
2. Kahana, A., Zhang, E., **Goswami**, **S.**, Karniadakis, G. E., Ranade, R., & Pathak, J. (2022). *On the geometry transferability of the hybrid iterative numerical solver for differential equations*.
3. Kontolati, K., **Goswami**, **S.**, Shields, M. D., & Karniadakis, G. E. (2022). *On the influence of over-parameterization in manifold based surrogates and deep neural operators*.

In Press

1. **Goswami**, **S.**, Bora, A., Yu, Y., & Karniadakis, G. E. (2022). *Physics-Informed Deep Neural Operator Networks: Accepted for a book chapter in Machine Learning in Modeling and Simulation–Methods and Applications*.

Journal Papers

1. Bharali, R., **Goswami**, **S.**, Anitescu, C., & Rabczuk, T. (2022). A robust monolithic solver for phase-field fracture integrated with fracture energy based arc-length method and under-relaxation. *Computer Methods in Applied Mechanics and Engineering*, *394*, 114587.

2. **Goswami**, **S.**, Li, D. S., Rego, B. V., Latorre, M., Humphrey, J. D., & Karniadakis, G. E. (2022). Neural operator learning of heterogeneous mechanobiological insults contributing to aortic aneurysms. *Journal of The Royal Society Interface*, *19*(193), 20220410.

3. **Goswami**, **S.**, Yin, M., Yu, Y., & Karniadakis, G. E. (2022). A physics-informed variational deeponet for predicting crack path in quasi-brittle materials. *Computer Methods in Applied Mechanics and Engineering*, *391*, 114587.

4. Lu, L., Meng, X., Cai, S., Mao, Z., **Goswami**, **S.**, Zhang, Z., & Karniadakis, G. E. (2022). A comprehensive and fair comparison of two neural operators (with practical extensions) based on fair data. *Computer Methods in Applied Mechanics and Engineering*, *393*, 114778.

5. Oommen, V., Shukla, K., **Goswami**, **S.**, Dingreville, R., & Karniadakis, G. E. (2022). Learning two-phase microstructure evolution using neural operators and autoencoder architectures. *npj Computational Materials*, *8*(190).

6. **Somdatta Goswami***, Kontolati*, K., Shields, M. D., & Karniadakis, G. E. (2022). Deep transfer operator learning for partial differential equations under conditional shift. *Nature Machine Intelligence*, 1–10.

7. Chatterjee, T., Chakraborty, S., **Goswami**, **S.**, Adhikari, S., & Friswell, M. I. (2021). Robust topological designs for extreme metamaterial micro-structures. *Scientific Reports*, *11*(1), 1–14.

8. **Goswami**, **S.**, Anitescu, C., Chakraborty, S., & Rabczuk, T. (2020). Transfer learning enhanced physics informed neural network for phase-field modeling of fracture. *Theoretical and Applied Fracture Mechanics*, *106*, 102447.

9. **Goswami**, **S.**, Anitescu, C., & Rabczuk, T. (2020a). Adaptive fourth-order phase field analysis for brittle fracture. *Computer Methods in Applied Mechanics and Engineering*, *361*, 112808.

10. **Goswami**, **S.**, Anitescu, C., & Rabczuk, T. (2020b). Adaptive fourth-order phase field analysis using deep energy minimization. *Theoretical and Applied Fracture Mechanics*, 102527.

11. Samaniego, E., Anitescu, C., **Goswami**, **S.**, Nguyen-Thanh, V., Guo, H., Hamdia, K., … Rabczuk, T. (2020). An energy approach to the solution of partial differential equations in computational mechanics via machine learning: Concepts, implementation and applications. *Computer Methods in Applied Mechanics and Engineering*, *362*, 112790.

12. **Goswami**, **S.**, Anitescu, C., & Rabczuk, T. (2019). Adaptive phase field analysis with dual hierarchical meshes for brittle fracture. *Engineering Fracture Mechanics*, *218*, 106608.

13. **Goswami**, **S.**, Chakraborty, S., Chowdhury, R., & Rabczuk, T. (2019). Threshold shift method for reliability-based design optimization. *Structural and Multidisciplinary Optimization*, *60*(5), 2053–2072.

14. **Goswami**, **S.**, Chakraborty, S., & Rabczuk, T. (2019). A surrogate assisted adaptive framework for robust topology optimization. *Computer Methods in Applied Mechanics and Engineering*, *346*, 63–84.

15. **Somdatta Goswami**, Ghosh, S., & Chakraborty, S. (2016). Reliability analysis of structures by iterative improved response surface method. *Structural Safety*, *60*, 56–66.

Conference Papers

1. Mukherjee, R., Meinia, S. K., **Goswami**, **S.**, & Negi, G. (2019). Objective evaluation of poor veins using image processing technique: An outcome analysis. In *Scientific Session – Finding Solutions for Donor Problems. The 30th regional congress of the International Society of Blood Transfusion* (pp. 10–11).
2. **Goswami**, **S.**, & Chakraborty, S. (2014). Adaptive response surface method based efficient monte carlo simulation. In *Vulnerability, Uncertainty, and Risk: Quantification, Mitigation, and Management* (pp. 2043–2052).
3. **Goswami**, **S.**, Chakraborty, S., & Ghosh, S. (2013). Adaptive response surface method in structural response approximation under uncertainty. In *International Conference on Structural Engineering and Mechanics* (pp. 194–202).

Talks and Presentations

Invited Talks

Dec 2022 — **Penn State University-Purdue University-University of Maryland, Joint Seminar on Mathematical Data Science.**
Transfer learning in Deep Neural Operators.

Nov 2022 — **Vanderbilt University, Emerging Scholars Seminar**
Scientific machine learning: Research at the Intersection of Mathematics, Computing, and Data.

Oct 2022 — **Advanced Modeling and Simulations Seminar Series, The University of Texas at El Paso.**
At the crossroads of Numerical Modeling & Machine Learning for Mechanics.

Aug 2022 — **Los Alamos National Laboratory.**
Scientific machine learning: Bridging physical models and observational data.

Dec 2021 — **NASA Langley Research Center.**
Physics informed deep learning methods for brittle fracture.

Nov 2021 — **George Washington University**.
Physics informed deep learning methods: a solution to bridge data gap in computational mechanics

May 2020 — **Brown University**.
Phase field modeling of fracture with isogeometric analysis and machine learning methods

Conference Presentations

Apr 2022 — **An Efficient Multiscale Surrogate for Brittle Fracture Analysis**
Society for Industrial and Applied Mathematics – UQ22

Dec 2018 — **An efficient framework for fracture analysis of brittle materials**
Structural Engineering Convention 2018

Topology optimization under uncertainty
Structural Engineering Convention 2018

Achievements

Grants

2022 - 2023 **U.S. Department of Energy for ASCR Leadership Computing Challenge (ALCC) award.**
A Multiscale Surrogate Model for Fracture Evolution using DeepONet.
Awarded 150,000 Node Hours.

2022 **ALCF Director's Discretionary Startup Allocation Grant for developing and scaling multi-scale fracture codes.**
RITM0208173: Multi-scale fracture using DeepONet.

2021 - 2022 **XSEDE startup grant for developing multi-scale codes, Texas Advanced Computing Center (TACC)**
CIS210111: Surrogate modeling for multiscale fracture analysis using DeepONets.

Awards

2022 **Selected for the Argonne Training Program on Extreme-Scale Computing, 2022.**

2021 **INSPIRE Faculty Fellowship, Department of Science and Technology, India**.

Postdoctoral Research Associate Funding, Division of Applied Mathematics, Brown University, USA

2018 **Best Paper Award in the Reliability and Optimization category at the Structural Engineering Convention 2018, Kolkata, India.**

2017 **DAAD Fellowship for pursuing Ph.D. at Bauhaus University Weimar, Germany.**

2011 **MHRD scholarship for pursuing Master's degree at Indian Institute of Engineering Sciences and Technology, Shibpur, India.**

Professional Services

- Mentoring female doctoral candidates (WISA+) at Bauhaus University-Weimar.
- Minisymposium Organizer: GACM Colloquium on Computational Mechanics (2022), SIAM Conference on Computational Science and Engineering (2023), U.S. National Congress Conference on Computational Mechanics (2023).
- Journal Reviewer: Computer Methods in Applied Mechanics and Engineering, International Journal of Rock Mechanics and Mining Sciences, Engineering with Computers, Defence Technology, International Journal of Impact Engineering, Reliability Engineering and System Safety, International Journal of Computational Methods, Frontiers of Structural and Civil Engineering, Energies, Sadhana, Computer and Mathematics with Applications, Scientific Reports, Engineering Fracture Mechanics, ICML-AI4Science, MTI, Applied Sciences.

References

Dr. George Karniadakis
Professor
Applied Mathematics Department
Brown University, U.S.A.
george_karniadakis@brown.edu

Dr. Timon Rabczuk
Professor
Civil Engineering Department
Bauhaus University-Weimar,
Germany.
timon.rabczuk@uni-weimar.de

Dr. Subrata Chakraborty
Professor
Civil Engineering Department
Indian Institute of Engineering Sciences & Technology, India.
schak@civil.iiests.ac.in