

S. Jain
Assistant Professor
Delft Institute of Applied Mathematics



Research profile

Shobhit Jain is an assistant professor at the Delft Institute of Applied Mathematics (Numerical Analysis section). His research focuses on the development of computational methods and scientific software that enable modelling, analysis and robust reduction of high-dimensional, nonlinear dynamical systems found in applied science and engineering.

Qualifications

Doctorate, Doctor of Sciences (ETH Zurich), ETH Zürich
2016 → 2019

Master's degree, Applied Mathematics, Delft University of Technology
2014 → 2015

Master's degree, Precision and Microsystems Engineering, Delft University of Technology
2013 → 2015

Bachelor's degree, Indian Institute of Technology Roorkee
2007 → 2011

Research interests

Dynamical systems, Model reduction, Computational mechanics

Research outputs

Computing parameter-dependent invariant manifolds for data-free nonlinear model reduction

Jain, S. & Li, M., 2026, In: Nonlinear Dynamics. 114, 15, 33 p., 1012.

Corrigendum to: "Nonlinear Model Reduction to Random Spectral Submanifolds in Random Vibrations" (Journal of Sound and Vibration, (2025), 600, C, (118923), (S0022460X24006862), 10.1016/j.jsv.2024.118923)

Kaundinya, R. S., Marraffa, A., Xu, Z., Jain, S. & Haller, G., 2026, In: Journal of Sound and Vibration. 626, 3 p., 119624.

Predicting Generalized Steady States in Aperiodically Forced Mechanical Systems

Kaundinya, R. S., Thiel, I., Kaszás, B., Jain, S. & Haller, G., 2026, In: Journal of Sound and Vibration. 643, 29 p., 120026.

Topology optimization of nonlinear forced response curves via reduction on spectral submanifolds

Liang, H., Pozzi, M., Marconi, J., Jain, S. & Li, M., 2026, In: Nonlinear Dynamics. 114, 10, 21 p., 713.

Adjoint sensitivities for the optimization of nonlinear structural dynamics via spectral submanifolds

Pozzi, M., Marconi, J., Jain, S., Li, M. & Braghin, F., 2025, In: Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences. 481, 2328, 28 p., 20250244.

Data-free non-intrusive model reduction for nonlinear finite element models via spectral submanifolds

Li, M., Thurnher, T., Xu, Z. & Jain, S., 2025, In: Computer Methods in Applied Mechanics and Engineering. 434, 17 p., 117590.

Nonlinear model reduction to random spectral submanifolds in random vibrations

Xu, Z., Kaundinya, R. S., Jain, S. & Haller, G., 2025, In: Journal of Sound and Vibration. 600, 19 p., 118923.

Response to "Discussion of S. Ponsioen, S. Jain and G. Haller: 'Model reduction to spectral submanifolds and forced-response calculation in high-dimensional mechanical systems', Journal of Sound and Vibration 488, 2020, pages 1-23"
Ponsioen, S., Jain, S. & Haller, G., 2025, In: Journal of Sound and Vibration. 597, 118791.

Topology optimization of nonlinear structural dynamics with invariant manifold-based reduced order models
Pozzi, M., Marconi, J., Jain, S., Li, M. & Braghin, F., 2025, In: Structural and Multidisciplinary Optimization. 68, 4, 72.

Backbone curve tailoring via Lyapunov subcenter manifold optimization
Pozzi, M., Marconi, J., Jain, S. & Braghin, F., 2024, In: Nonlinear Dynamics. 112, 18, p. 15719-15739 21 p.

Bifurcation analysis of quasi-periodic orbits of mechanical systems with 1:2 internal resonance via spectral submanifolds
Liang, H., Jain, S. & Li, M., 2024, In: Nonlinear Dynamics. 113, 11, p. 12609-12640 32 p., 906324.

Data-assisted non-intrusive model reduction for forced nonlinear finite elements models
Cenedese, M., Marconi, J., Haller, G. & Jain, S., 2024, In: Nonlinear Dynamics. 113, 7, p. 6465-6489 25 p.

Fast computation and characterization of forced response surfaces via spectral submanifolds and parameter continuation
Li, M., Jain, S. & Haller, G., 2024, In: Nonlinear Dynamics. 112, 10, p. 7771-7797 27 p.

Nonautonomous spectral submanifolds for model reduction of nonlinear mechanical systems under parametric resonance
Thurnher, T., Haller, G. & Jain, S., 2024, In: Chaos. 34, 7, 27 p., 073127.

Nonlinear model reduction from equations and data
Pagliantini, C. & Jain, S., 2024, In: Chaos (Woodbury, N.Y.). 34, 9, 3 p., 090401.

Reduced Order Modeling Research Challenge 2023: Nonlinear Dynamic Response Predictions for an Exhaust Cover Plate
Park, K., Allen, M. S., de Bono, M., Colombo, A., Frangi, A., Gobat, G., Haller, G., Hill, T., Jain, S., Kramer, B., Li, M., Salles, L., Najera-Flores, D. A., Neild, S., Renson, L., Saccani, A., Sharma, H., Shen, Y., Tiso, P. & Todd, M. D. & 6 others, Touzé, C., Van Damme, C., Vizzaccaro, A., Xu, Z., Elliot, R. & Tadmor, E., 2024, *Nonlinear Structures and Systems - Proceedings of the 42nd IMAC, A Conference and Exposition on Structural Dynamics 2024*. Brake, M. R. W., Renson, L., Kuether, R. J. & Tiso, P. (eds.). Cham: Springer, Vol. 1. p. 51-56 6 p. (Conference Proceedings of the Society for Experimental Mechanics Series).

Model reduction for constrained mechanical systems via spectral submanifolds
Li, M., Jain, S. & Haller, G., 2023, In: Nonlinear Dynamics. 111, 10, p. 8881-8911 31 p.

How to compute invariant manifolds and their reduced dynamics in high-dimensional finite element models
Jain, S. & Haller, G., 2022, In: Nonlinear Dynamics. 107, 2, p. 1417-1450 34 p.

Nonlinear analysis of forced mechanical systems with internal resonance using spectral submanifolds, Part I: Periodic response and forced response curve
Li, M., Jain, S. & Haller, G., 2022, In: Nonlinear Dynamics. 110, 2, p. 1005-1043 39 p.

Using Spectral Submanifolds for Nonlinear Periodic Control
Mahlknecht, F., Alora, J. I., Jain, S., Schmerling, E., Bonalli, R., Haller, G. & Pavone, M., 2022, *2022 IEEE 61st Conference on Decision and Control, CDC 2022*. IEEE, p. 6548-6555 8 p. (Proceedings of the IEEE Conference on Decision and Control; vol. 2022-December).

Integral equations and model reduction for fast computation of nonlinear periodic response
Buza, G., Haller, G. & Jain, S., 2021, In: International Journal for Numerical Methods in Engineering. 122, 17, p. 4637-4659 23 p.

Using spectral submanifolds for optimal mode selection in nonlinear model reduction

Buza, G., Jain, S. & Haller, G., 2021, In: *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*. 477, 2246, 20200725.

Model order reduction for temperature-dependent nonlinear mechanical systems: A multiple scales approach

Jain, S. & Tiso, P., 2020, In: *Journal of Sound and Vibration*. 465, 115022.

Model reduction to spectral submanifolds and forced-response calculation in high-dimensional mechanical systems

Ponsioen, S., Jain, S. & Haller, G., 2020, In: *Journal of Sound and Vibration*. 488, 115640.

Fast computation of steady-state response for high-degree-of-freedom nonlinear systems

Jain, S., Breunung, T. & Haller, G., 2019, In: *Nonlinear Dynamics*. 97, 1, p. 313-341 29 p.

Hyper-Reduction over Nonlinear Manifolds for Large Nonlinear Mechanical Systems

Jain, S. & Tiso, P., 2019, In: *Journal of Computational and Nonlinear Dynamics*. 14, 8, 081008.

Exact nonlinear model reduction for a von Kármán beam: Slow-fast decomposition and spectral submanifolds

Jain, S., Tiso, P. & Haller, G., 2018, In: *Journal of Sound and Vibration*. 423, p. 195-211 17 p.

Simulation-free hyper-reduction for geometrically nonlinear structural dynamics: A quadratic manifold lifting approach

Jain, S. & Tiso, P., 2018, In: *Journal of Computational and Nonlinear Dynamics*. 13, 7, 071003.

A quadratic manifold for model order reduction of nonlinear structural dynamics

Jain, S., Tiso, P., Rutzmoser, J. B. & Rixen, D. J., 2017, In: *Computers and Structures*. 188, p. 80-94 15 p.

Generalization of quadratic manifolds for reduced order modeling of nonlinear structural dynamics

Rutzmoser, J. B., Rixen, D. J., Tiso, P. & Jain, S., 2017, In: *Computers and Structures*. 192, p. 196-209 14 p.

Simulation-free hyper-reduced models for geometrically nonlinear structural dynamics

Jain, S. & Tiso, P., 2017, *17th International Forum on Aeroelasticity and Structural Dynamics, IFASD 2017*. International Forum on Aeroelasticity and Structural Dynamics (IFASD), (17th International Forum on Aeroelasticity and Structural Dynamics, IFASD 2017; vol. 2017-June).

Quadratic manifolds for reduced-order modelling of highly flexible multibody systems

Wu, L., Tiso, P., Jain, S. & Van Keulen, F., 2015, *Proceedings of the ECCOMAS Thematic Conference on Multibody Dynamics 2015*. Font-Llagunes, J. M. (ed.). Barcelona, Spain: International Center for Numerical Methods in Engineering, p. 422-430

Datasets/Software

SSMTool

Jain, S. (Creator), Thurnher, T. (Contributor), Li, M. (Contributor) & Haller, G. (Contributor), Zenodo, 18 Oct 2022
DOI: 10.5281/zenodo.4614201

YetAnotherFECODE

Jain, S. (Creator), Marconi, J. (Contributor) & Tiso, P. (Contributor), Zenodo, 11 Nov 2022
DOI: 10.5281/zenodo.4011281