HAI VAN NGUYEN

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EDUCATION

PhD's in Aerospace Engineering Jan. 2021 - Present
University of Texas at Austin, Department of Aerospace Engineering and Engineering Mechanics
Advisor: Assoc. Prof. Tan Bui-Thanh

Master's in Civil Engineering Sep. 2015 - Jun. 2017
Ho Chi Minh City University of Technology, Faculty of Civil Engineering
Thesis: "Nonlinear Plastic-Zone Analysis of Planar Semi-Rigid Steel Frames subjected to Static-Load using Co-rotational Finite Elements".
Advisor: Assoc. Prof. Ngo Huu Cuong

B.E. in Industrial and Civil Engineering Sep. 2010 - Jun. 2015
Ho Chi Minh City University of Technology

PHD RESEARCH

Model-constrained deep learning methods for forward and inverse problems: Deep Learning (DL), in particular deep neural networks (DNN), by design is purely data-driven and in general does not require physics. This is the strength of DL but also one of its key limitations when applied to science and engineering problems in which underlying physical properties, such as stability, conservation, and positivity, and desired accuracy need to be achieved. DL methods in their original forms are not capable of respecting the underlying mathematical models or achieving desired accuracy even in big-data regimes. On the other hand, many data-driven science and engineering problems, such as inverse problems, typically have limited experimental or observational data, and DL would overfit the data in this case. Leveraging information encoded in the underlying mathematical models not only compensates missing information in low data regimes but also provides opportunities to equip DL methods with the underlying physics and hence obtaining higher accuracy. I am interested in developing deep learning methods that could exploit the underlying physical laws and/or their mathematical discretization to improve the DL generalizability and accuracy for engineering and sciences problems.

SKILLS

Programing Language: Python (JAX, Pytorch, Tensorflow), MATLAB, Fortran.

Support Software: Visual Studio Code, Firedrake, Fenics, ABAQUS, MAPLE.

EXPERIENCE

Teaching assistant Austin, Texas, USA
. *Aug. 2021 - Present*

- Graduate course: Analytical Methods I;
- Graduate course: Analytical Methods II;
- Graduate course: Introduction to Machine Learning;

Teaching and graduate reasearch assistant Ho Chi Minh city, Vietnam
. *Jun. 2017 - Nov. 2020*

- Teaching on Steel Structures 1 (Basic members) and Steel Structures 2 following to Eurocode 3;
- Design project: Elastic design of single-span steel portal frame building using Eurocode 3 standard

Internship at JFE Steel Corporation Japan
Steel Research Laboratory *Jul. 2018 - Sep. 2018*

- Research on steel pipe pile foundation design and geological ground survey

RESEARCH EXPERIENCE

Machine learning, Inverse problem, Uncertainty qualification Austin, Texas, USA
(PhD Research) *Jan. 2021 - present*

- Model-constrained deep learning approach for solving PDEs.
- Model-constrained deep learning approach for inverse problems.

- Data-informed active subspace framework for solving inverse problems
- Unified randomized methods for inverse problems
- Modeling epidemic spread.

Structural Analysis, finite element methods Ho Chi Minh, Vietnam
(Master research and graduate research assistant) *Sep. 2015 - Nov. 2020*

- Studied the Direct Design Method for portal steel frames using advanced analysis according to the provisions of ANSI/AISC 360-16
- Coded a program for elastic and inelastic analyses planar semi-rigid frames under dynamic loads using co-rotational elements
- Developed a FEM program for non-linear plastic analysis of 3D steel frames using updated Larangian formulation.
- Investigated the second-order elastic behavior of steel tapered members and frames under static loading by using total Lagrange approach.
- Modeled and analyzed the influence of bolt-slip effects on the response of Steel Space Structures.

PUBLICATIONS

- Van Nguyen, Hai, and Tan Bui-Thanh. "A Model-Constrained Tangent Manifold Learning Approach for Dynamical Systems." arXiv preprint arXiv:2208.04995 (2022).
- Nguyen, Hai, Jonathan Wittmer, and Tan Bui-Thanh. "DIAS: A Data-Informed Active Subspace Regularization Framework for Inverse Problems." Computation 10, no. 3 (2022): 38.
- Nguyen, Hai V., and Tan Bui-Thanh. "Model-constrained deep learning approaches for inverse problems." arXiv preprint arXiv:2105.12033 (2021).
- Van Hai, Nguyen, Doan Ngoc Tinh Nghiem, and Ngo Huu Cuong. "Large displacement elastic analysis of planar steel frames with flexible beam-to-column connections under static loads by corotational beam-column element." Journal of Science and Technology in Civil Engineering (STCE)-HUCE 13, no. 3 (2019): 85-94.
- Van Hai, Nguyen, Doan Ngoc Tinh Nghiem, and Ngo Huu Cuong. "Large displacement elastic static analysis of semi-rigid planar steel frames by corotational Euler–Bernoulli finite element." Journal of Science and Technology in Civil Engineering (STCE)-HUCE 13, no. 2 (2019): 24-32.

CONFERENCES

- **Mini-symposium organizer** *Scientific Deep Learning.* 5th Annual Meeting of the SIAM Texas-Louisiana Section, November 4th - November 6th, 2022, Houston, Texas, U.S.
- **Invited talk** *A Model-Constrained Tangent Slope Learning Approach for Dynamical Systems.* 5th Annual Meeting of the SIAM Texas-Louisiana Section, November 4th - November 6th, 2022, Houston, Texas, U.S.
- **Invited talk + poster presentation (Traveling reward)** *TNET: Model-Constrained Deep Learning Approach for Inverse Problems.* 5th Annual Meeting of the SIAM Texas-Louisiana Section, November 4th - November 6th, 2022, Houston, Texas, U.S.
- **Invited talk** *A Model-Constrained Tangent Slope Learning Approach for Dynamical Systems.* SIAM Conference on Mathematics of Data Science (MDS22), September, 26-30, 2022 in San Diego, CA.
- **Invited talk (Traveling reward)** *TNET: Model-Constrained Deep Learning Approach for Inverse Problems.* USACM Thematic Conference on Uncertainty Quantification for Machine Learning Integrated Physics Modeling (UQ-MLIP) August 18-19, 2022, Crystal City, Arlington, Virginia, U.S. .
- **Invited talk** *Model-constrained deep learning approach for solving forward and inverse problems.* SIAM Conference on Uncertainty Quantification (UQ22), April 12 - 15, 2022, Westin Peachtree Plaza, Atlanta, Georgia, U.S.)

REFERENCES

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Dr. Eng. Takuya Murakami
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