ANH (FRANK) LE

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PROFESSIONAL SUMMARY

Water resources researcher specializing in physics-informed machine learning for hydraulic modeling and bathymetry inversion. Expertise in solving partial differential equations through computational methods, integrating UAV-derived data with hydrodynamic models, and developing novel measurement-free approaches for river characterization. Experienced in advancing R&D workflows with HPC acceleration, Bayesian uncertainty quantification, and AI applications in hydraulic modeling.

EDUCATION

Ph.D. in Civil Engineering, Focus: Water Resources and AI *Expected 2028*
North Dakota State University — Specialization in Physics-Informed Machine Learning, Hydraulics, and Uncertainty Quantification

M.S. in Construction Management, First Class Honors *2020*
Ho Chi Minh City University of Technology

B.Eng. in Industrial and Civil Engineering *2018*
Ho Chi Minh City University of Technology

EXPERIENCE

Graduate Research Assistant — Water Resources Engineering *Jan 2024 — Present*
North Dakota State University *Fargo, ND*

- **Accelerated Physics-Informed Neural Network (PINN) training by 70%** through GPU/CUDA optimization in JAX, enabling real-time experimentation for PDE-based hydraulic modeling
- **Developed a measurement-free bathymetry inversion framework** solving Shiono–Knight Method PDEs to recover river depth profiles from UAV-derived surface velocity data
- Integrated UAV remote sensing data with PDE-constrained neural networks to improve non-contact bathymetry estimation for R&D applications
- Applied Bayesian uncertainty quantification and Polynomial Chaos Expansion to generate confidence intervals and quantify prediction reliability

KEY RESEARCH PROJECT

Measurement-Free Bathymetry Inversion using Physics-Informed Machine Learning *2024–Present*

- Developed novel PINN-based framework for non-invasive river depth recovery, solving Shiono-Knight Method PDEs to reconstruct bathymetry $H(y)$ from UAV-derived surface velocity measurements $U_d(y)$ without requiring traditional depth surveys
- Pioneered integration of remote sensing data with PDE-constrained neural networks for hydraulic R&D, demonstrating feasibility of measurement-free river characterization for flood modeling and channel design applications
- Integrated Monte Carlo simulation and Bayesian PINNs for robust uncertainty quantification, providing probabilistic depth estimates critical for risk-informed hydraulic engineering decisions
- Utilized HEC-RAS, Tecplot, and QGIS for validation and visualization of bathymetry reconstructions against benchmark scenarios

PAPERS IN PROGRESS

Le, A., Souri J., & Le, T. B. (In preparation). *Physics-Informed Neural Network for Measurement-Free Bathymetry Inversion Using the Shiono–Knight Method.* Target journal: *Water Resources Research (AGU).*

TECHNICAL SKILLS

Water Resources: Open-channel hydraulics, river bathymetry inversion, culvert/levee analysis, hydrodynamic modeling, UAV-based hydraulic measurements
Hydraulic Software: HEC-RAS, HY8, Tecplot, QGIS, ArcGIS
Modeling & ML: Physics-informed neural networks (PINNs), solving PDEs with neural networks, Bayesian inference, graph neural networks, time-series forecasting
HPC & Computing: MATLAB, GPU/CUDA parallelization, distributed training (JAX, PyTorch)
Programming: Python (scikit-learn, TensorFlow, Flax)