PAN XINXIN

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Research Interests: Sediment Transport; Flow-Sediment-Vegetation Interaction; NbS in Coastal Protections

EDUCATION

National University of Singapore (NUS), Singapore   **Aug 2023 - Jun 2024**

Master of Science, Civil Engineering in Sustainable Climate Resilience (Digital Water)

- **GPA:** 3.6/5.0
- **Coursework:** Sediment Transport and Coastal Processes; Numerical Methods for Environmental Flows; Nature-based Solutions (NbS) for Coastal Protection; Open Channel Hydraulics; Eco-Hydrology; Climate Science; Water Resources Modelling; Hydro-Informatics.
- **Research Skills:** Experimental Fluid Mechanics (ADV); Numerical Modeling (MATLAB) and CFD, Statistical Analysis and Machine Learning (Python/R).

Hohai University (HHU), China   **Sep 2016 - Jun 2020**

Bachelor of Engineering, Water and Hydropower Engineering

- **GPA:** 4.15/5.0 (Ranking in the top 25%)
- **Coursework:** Hydraulics and Hydraulic Experiments; Water Structure Design (Dams & Channel); River Dynamics; Applied Elasticity and Finite Element Method; Structural and Soil Mechanics.
- **Awards:** Honorable Prize in the International Mathematical Contest in Modelling (top 15%); Outstanding Graduate of HHU in 2020; Artistic and Athletic Scholarship at HHU (top 5%).

ACADEMIC PROJECTS

Analytical Solutions and Lab Experiments of Sediment Transport   **Mar 2024 - May 2024**

Programming and Experiments for SSC and Bedforms within Wave and Current Led by Prof. Pearl

- Derived formulae of sediment transport mechanics in Fredsoe's study, and translated analytical solutions into MATLAB code, including grain-size effects on SSC distribution.
- Applied these solutions for coastline modeling within wave driven long-shore currents, and compared different model for breaker bar simulation with constraint on cross-shore sediment.
- Experienced in lab experiments and data post-processing about sand motion and bedform transition.

Sensitivity Analysis of Eco-hydrology Properties & NbS Design   **Feb 2024 - May 2024**

A Simulation of Vegetation Productivity in Singapore and a Living Shoreline Design in Byron Bay, AUS

- Quantified impacts of soil properties and variation in meteorological forcing of vegetation productivity (i.e., NPP&GPP, photosynthesis) using T&C MATLAB code, and analysed by Python.
- Designed artificial reefs as NbS to mitigate erosion in foreshore zone, and defined 40% of the wave attenuation effect; Optimized its size as coastal and terrestrial parameters by SWASH model results.

Study of Numerical Methods for Ocean Hydrodynamics using Delft3D   **Sep 2023 - Dec 2023**

- To define maximum allowable discharge limits into oceans, considering thermal plume constraints, collected, cleaned, and processed oceanographic data, including wave properties and bathymetry; created flexible mesh and enhanced model accuracy by diffusivity coefficient, time-lag parameters.
- Mixing/Diffusion Model: Simulated tide-dominated estuarine circulation for salinity and stratification, and assessed salt wedge change with increasing tidal amplitude.

Rainfall-runoff analysis using QGIS, WFLOW & ANN Algorithm   **Jan 2024 - Apr 2024**

- Built rainfall-runoff models by observation and parameters to estimate possible extreme flooding.
- Collected hydrologic data and rainfall events; Preprocessed datasets and trained an ANN LSTM model in python and a MLP model in R, both showing more than 90% forecast accuracy.

A Practice of Transient 2D Heat Conduction Model by MATLAB   **Aug 2023 - Oct 2023**
- Solved PDEs for heat conduction using various schemes (e.g., BTCS and FDM) and implemented them in MATLAB code. Proposed analytic solution for transient 2D heat conduction problem and compared variances in CDM and FSTM for stable results.

Assessment of Sediment in a Widening Channel Interfered by Weirs   **Sep 2023 - Dec 2023**
(Team Leader) A Project about Open Channel Hydraulics at NUS (Highest Scoring Thesis)
- Demonstrated overall effectiveness of a channel optimization by assessing Fr number pre- and post-implementation within a river channel; Verified asymmetric weir effects in flow velocity and sediment, and illustrated how an optimal size of weir reduced TKE and suspension sediment.
- Contribution: Proposed research methodology and completed the final report; Simulated water level in two scenarios by DHI MIKE and turbulence around various weirs by *RNG k-ε* model in FLOW3D, and assessed sediment and erosion rate using flow conditions.

Improved Wedge-shaped Block as Flip Bucket at the Dam Spillway   **Mar 2019 - Jan 2020**
(Team Leader) An Innovative Project Executed in the Hydraulics Lab at HHU Led by Prof. Fu
- Proposed an innovative X-shaped block to enhance turbulence and energy dissipation at a spillway; Validated conceptual design by FLOW3D and by a physical test.
- Contribution: Collected dissipating efficiency within *RNG k-ε* model; Processed flow velocity in physical measurements; Built a linear model to choose optimal scheme; Conducted the final thesis.

ACADEMIC PAPERS AND PATENTS
- Analysis of the Influence of River Cross-Section Shape on the Hydraulic Characteristics of River Based on Flow3D Model, *Technology Information* (ISSN: 2096-4390, CN: 23-1600/N) (*09/2019*)
- Application of Macroscopic Fluid Dynamics Simulation in Mathematical Modeling of Crowd Movement, *Science and Technology Innovation* (ISSN: 1672-3791, CN: 11-5042/N) (*06/2019*)
- Patent: Improved Wedge-shaped Energy Dissipating Blocks Based on Flip Bucket (*05/2020*)

WORK EXPERIENCE
Coastal & Water Structural Engineer   **Jul 2020 - Jun 2022**
Shenzhen Water Planning & Design Institute Co., Ltd., China
- Involved in a seawall project with mangroves in the foreshore. In the absence of guidelines for quantifying wave attenuation in mangrove scenarios, applied theoretical formulas and case studies to estimate a 20% reduction in wave height. Proposed a more cost-effective seawall design.
- Led a team to assess a road-river cross-engineering and proposed an effective interdisciplinary solution using geotechnical and hydrological model (MIDAS, DHI MIKE) with QGIS.
- Completed several seawall reconstruction projects in estuaries, considering sea-level rise and extreme climate conditions. Calculated wave and sediment properties and improved digital design methods using Civil3D for spatial analysis. Assessed seepage stability with AutoBank FEM.

KILLS AND SELF-EVALUATION
- Software: 1) **Modelling:** Delft3D, DHI MIKE, FLOW3D, QGIS, MidasGTS, Civil3D; AutoBank; 2) **Script:** MATLAB, R, Python; 3) **Others**: Zotero, Tableau, SPSS, CAD, RevitBIM, SketchUp.
- Strong academic background in coastal and fluvial processes, including sediment dynamics in wave-current and analytical solutions of shoreline modelling, and eco-hydraulics (FSI).
- Proficiency with NbS applications, numerical methods for coastal processes, experiments for seagrass and sand motion, and data processing and statistical analysis.
- Extensive experience in proposing methodologies and academic writing.
- Strong leadership and execution abilities, with high level of self-motivation.
- Certified Water Structural Assistant Engineer in China with proven problem-solving skills, and experienced in engineering solution for SLR and NbS in tidal marshes.