PAN XINXIN

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Research Interests: Sediment Transport; Marsh Erosion; Coastal Morphology; Wave Dynamics.

EDUCATION

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

Master of Science, Civil Engineering in Sustainable Climate Resilience, GPA: 3.6/5.0

- **Coursework:** Nature-based Solutions (NbS) for Coastal Protection; Sediment Transport and Coastal Processes; Numerical Methods for Environmental Flows; Open Channel Hydraulics; Eco-Hydrology; Climate Science; Water Resources Modelling; Hydro-Informatics.
- **Research Skills:** Experimental Fluid Mechanics (ADV); Numerical Modeling (Delft3D, MATLAB) and CFD (FLOW3D, OpenFOAM); Geospatial Analysis (QGIS); Machine Learning (Python/R).
- **Recommenders:** *Assistant Prof. Gary Lei*; *Assistant Prof. Pearl Li*; *Dr. Ooi Seng Keat*.

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

Bachelor of Engineering, Water and Hydropower Engineering, GPA: 4.15/5.0 (Top 20%)

- **Coursework:** Hydraulics and Experiments; Hydraulic Structure (Dams & Channels); River Dynamics; Finite Element Method; Water Resources Planning; Technology of Numerical Simulation for Water.
- **Awards:** Honorable Mention Prize in the International Mathematical Contest in Modelling (*Top 10%*); HHU Outstanding Graduate in 2020; HHU Artistic and Athletic Scholarship (*Top 5%*), 2017~2020; (*HHU Basketball Team Captain)*2nd Place in Basketball Competition at the Jiangsu Provincial Game.

ACADEMIC PROJECTS

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

Numerical and Physical Modeling of Sediment Transport in Wave-Current and Coastline with Dr. Pearl Li

- Implementation of a MATLAB model framework for sediment transport integrating implicit solutions for settling velocity, Fredsøe approach for reference concentration, and depth-integrated equations.
- Visualization for changes in flow resistance components and bedform transitions in various currents.
- Derivation of a simplified coastline model for groynes interacting with longshore transport within wave.
- ADV based flow measurements for sand motion and bedform transition validation in Shields Diagram.
- Simulation of fluid flow around a cylinder using '*icoFoam*' solver in OpenFOAM/C++.
- Exploration of various empirical methods for bedload transport rate in Delft3D subroutines '*eqtan.f90*'.

Sensitivity Analysis of Eco-hydrology Properties & A Living Shoreline Design **Feb 2024 - May 2024**

A Simulation of Vegetation Productivity in Singapore and NbS for Coastal Protection in Byron Bay, AUS

- Verified the impact of soil water content and variations in meteorological forcing on vegetation productivity (i.e., NPP, GPP) using the T&C MATLAB model, with data post-processing in R.
- Studied flow-vegetation interactions with *Dr. Gary* by fluid dynamics experiments, quantifying wave attenuation over flexible blades and rigid stems using empirical approaches and biomass parameters.
- Selected artificial reefs to mitigate coastal erosion, and estimated 40% of wave attenuation effect. Identified area with steady currents and gentle slopes, using wave simulation results in SWASH model.

Study of Numerical Mathematics & Methods Using MATLAB and Delft3D **Sep 2023 - Dec 2023**

- Mastered Finite Difference Methods (FDM) and solving PDEs by building a transient heat conduction model in MATLAB, applying various schemes (i.e., FTCS, BTCS) to assess stability and accuracy.
- Performed 2D/3D ocean hydrodynamic simulations to assess the impact of flow discharges on temperature diffusion extent and variation, integrating wave properties, bathymetry data, and flexible mesh grids. Conducted model calibration by adjusting parameters and performing statistical analysis, with data post-processing in the MATLAB framework.
- Simulated estuarine circulation for salinity and stratification in Delft3D, analyzing salt wedge dynamics under various tidal amplitudes, and testing different turbulence models and time-lag parameters. Identified the best-performing model for the vertical structure of baroclinic currents.

Assessment of Sediment Transport over Weirs in a Widening Channel **Sep 2023 - Dec 2023**

(Team Leader) A Project of Open Channel Hydraulics at NUS Led by Dr. Gary Lei (Highest Scoring Thesis)

- Verification of a more stable flow condition in post-widening channels through statistical analysis of Froude numbers and ideal Fr. Evaluation of steeper upstream slopes in weirs to narrow turbulence range and enhance erosion risk in downstream.
- **Contribution:** Proposed a research methodology. Finalized the thesis and presentation. Modeled water level changes in two channel scenarios by MIKE11 and simulated turbulence-induced FSI around weirs by FLOW3D RNG k-ε model. Implemented a MATLAB framework to analyze sediment transport.

Rainfall-Runoff Modeling by WFLOW.py & Machine Learning Algorithms **Aug 2023 - Apr 2024**

Hydrologic and Geospatial Analysis for the NUS Kent Ridge Catchment with Prof. Babovic

- Utilized WFLOW_sbm model in Python to simulate hydrological process (i.e., groundwater and surface flow routing), using rainfall datasets; processed high-resolution DEMs and flow direction map in QGIS.
- Developed and trained LSTM and MLP models in Python/R on rainfall datasets, achieving 90% accuracy; utilized a Kalman Filter for data assimilation to enhance model performance.

Design of X-Shape Structure on Deflector to Develop Energy Dissipation Rate **Mar 2019 - Jan 2020**

(Team Leader) An Innovative Project Executed in the HHU Hydraulics Lab Led by Prof. Fu

- Development of a novel methodology for conceptual design of X-shaped structure on deflector to be used on spillway to enhance energy dissipation rate, and validated in physical and numerical models.
- **Contribution:** Simulated FSI and surface jumps in FLOW3D *RNG k-ε* model. Conducted experiments using piezometer tube and velocity meter. Derived a nonlinear equation linking key geometrical parameters to the energy dissipation rate from data analysis. Drafted and finalized the paper.

ACADEMIC PAPERS AND PATENTS

- **Paper:** Sensitivity Analysis of Cross-Sectional Geometry on Hydraulic Characteristics in River Channels Using FLOW3D, *Technology Information* (ISSN: 2096-4390, CN: 23-1600/N) (*09/2019*)
- **Paper:** 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:** Energy Dissipation in Hydraulic Jumps Using X-Shape Structure on Deflector (*05/2020*)

WORK EXPERIENCE

Hydraulic Engineer *Shenzhen Water Planning&Design Institute Co., Ltd., China* **Jul 2020 - Jun 2022**

- **Job Description:** Responsible for feasibility studies and hydrologic and hydraulic design for over 15 medium-to-major water engineering projects, including coastal protections, channels, reservoirs, dams.
- Lead engineer on a living shoreline project using a hybrid system (mangroves + revetment). Applied relevant theories and case studies, and parameterized mangrove biomass to assess a 20% reduction in wave energy in mangrove zones. Developed seawall structural design based on wave calculation results.
- Led a team to assess the impact of backwater rise and scour effects caused by bridge piers on river channels, and proposed an effective solution integrating hydraulic models (MIKE11, FLOW3D) with empirical formulations. Conducted topographic and geotechnical analysis using MIDAS and ArcGIS.
- Completed several seawall reconstruction projects in estuaries, considering sea-level rise and extreme climate. Calculated wave and sediment properties and improved digital design methods using Civil3D.

SKILLS AND SELF-EVALUATION

- **Programming:** MATLAB, R, Python, Fortran (for compiling open-source models); Tableau, SPSS.
- **Modelling:** Delft3D, MIKE 11, FLOW3D, SWASH, OpenFOAM/C++; QGIS; MidasGTS, Civil3D, CAD, AutoBank FEM, RevitBIM, SketchUp.
- **Language:** Chinese (native); English (professional).
- Strong academic background in coastal processes, including sediment transport, wave dynamics and eco-hydrology, with proficiency in CFD, numerical methods, experiments, and data processing.
- Strong leadership and execution in academic practice and sports, driven by high self-motivation.
- Certified Water Structural Assistant Engineer in China with proven problem-solving skills in hydraulics.