

# PAN XINXIN



E1177292@u.nus.edu



<https://kingdaxing.github.io/>

Research Interests: Coastal Hydro- & Morpho-Dynamics; Sediment Transport; Shoreline Modelling.

## EDUCATION

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### 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:** Coastal Processes; Sediment Transport and Coastal Processes; Nature-based Solutions (NbS) for Coastal Protection; 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).
- **Recommendors:** 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:** River Dynamics; Hydraulics and Experiments; Hydraulic Structure (Dams & Channels); 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

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### 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 in Delft3D to assess the impact of flow discharges on temperature diffusion extent and variation, integrating wave properties and bathymetry data. Conducted model calibration by adjusting parameters and performing statistical analysis, with data processing in the MATLAB framework. Modelled bedload transport changes due to SLR.
- Exploration of various empirical methods for bedload transport rate in Delft3D subroutines '*eqtan.f90*'.

### 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, and studied van Rijn's evaluation method for beach nourishment.
- ADV based flow measurements for sand motion and bedform transition validation in Shields Diagram.

### Simple Solution of N-S Equations & Design of Wave Barriers in OpenFOAM

Sep 2024 - Nov 2024

- Evaluated the coastal structure design of a wave barrier through comparisons of water levels, velocity and pressure on the inner bay and outside part of the structure, using Salome for mesh generation and '*interFoam*' solver to simulate two-phase flow in wave-structure interaction.

### 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 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.

- Shoreline recognition and comparison using image recognition algorithm in Python/MATLAB.

### **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)*

- 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- $\epsilon$  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; conducted model evaluation with statistical analysis in Python.

### **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- $\epsilon$  model. Conducted physical experiments using piezometer tube and velocity meter. Derived a nonlinear equation linking key geometrical parameters to 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, China* **Jul 2020 - Jun 2022; Sep 2024 - Present**

- **Job Description:** Responsible for feasibility studies and hydrologic and hydraulic design for over 15 major water engineering projects, including coastal protections, river channels, estuaries and dams.
- Lead engineer on a living shoreline project using a hybrid system (mangroves + revetment). Applied NbS theories, and parameterized mangrove biomass to assess a 20% reduction in wave energy.
- Led the design of an artificial coastal outlet, assessing both current and projected coastline development. Conducted hydraulic and geospatial analyses using MIKE 11 and ArcGIS. Evaluated sediment transport conditions through empirical formulas and analytical methods.

## **SKILLS AND SELF-EVALUATION**

- **Programming:** MATLAB, Python, R, Fortran (for compiling open-source models); Tableau, SPSS.
- **Modelling:** Delft3D, OpenFOAM/Salome, FLOW3D, MIKE 11; QGIS; MidasGTS, Civil3D, CAD, AutoBank FEM, RevitBIM, SketchUp.
- **Language:** Chinese (native); English (professional).
- Solid academic background in **coastal processes and sediment transport**, including small-scale bedform transition, long- & cross-shore transport, and large-scale hydro- & morpho-dynamics.
- Proficient in numerical methods, CFD, and programming for statistical analysis and data processing.
- Strong leadership and execution in academic practice and sports, driven by high self-motivation.
- Certified Water Structural Assistant Engineer with proven problem-solving skills in coastal engineering.