IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title: **Wave impact on protective coastal structures**

Project Number **IMURA0357**

CSIRO

Monash Supervisor(s)	Prof Murray Rudman(Monash) Dr Mahesh Prakash(CSIRO)	*Full names and titles*
Monash Primary Contact:	Murray.Rudman@monash.edu	*Email, phone*
Monash Head of Department:	Prof. Chris Davies	*Full name, email*
Monash Department:	Mechanical & Aerospace Engineering	*Full name*
Monash ADRT:	Prof. Emmanuelle Viterbo	*Full name, email*
IITB Supervisor(s)	Prof Balaji Ramakrishnan	*Full names and titles*
IITB Primary Contact:	rbalaji@civil.iitb.ac.in	*Email, phone*
IITB Head of Department:	Prof. K V K Rao	*Name, Email,*
IITB Department:	kvkrao@iitb.ac.in	*Full name*

Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?
(*Feel free to nominate more than one. For more information, see www.iitbmonash.org)*

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

Define the problem

The recent frequent occurrences of climate change related events such as storm surges and tsunamis combined with ever increasing coastal infrastructure has resulted in the need for designing coastal protective structures that can address present and future needs. Breakwaters, Sea Walls and Groynes are the general variants of the protective structures employed to withstand wave forces on coastal and

inland infrastructure, reduce erosion and/or protect beaches. This proposed investigation is aimed at an analysis of those kinds of coastal structures designed to withstand wave forces that protect both coastal and inland infrastructure. Protective structures should ideally withstand different wave types across a wide range of conditions including different speed, angles of incidence and height. Most importantly, tsunami and wind-driven storm waves will be vastly different and could require different design strategies. To date, most investigations to understand the effectiveness of protective coastal structures have either been purely experimental or, more recently, purely numerical in nature with very limited validation. With recent advances in numerical modelling techniques and increased computational power one is now able to perform 3D numerical simulations that completely replicate the experimental setup providing a very sound basis for exhaustive validation for such problems.

Project aims

Define the aims of the project

To obtain good experimental validation data for wave impacts on coastal protective structures. To develop a Smoothed Particle Hydrodynamics (SPH) model to simulate such impacts. To validate the simulations of the experimental tests to establish their accuracy, that will then guide future development of the numerical methods.

Expected outcomes

Highlight the expected outcomes of the project

The outcomes of this project would first and foremost be a quality Ph.D. graduate with industrially relevant skills in both physical and computational modelling and domain knowledge in an area that is of importance in marine/coastal hydrodynamics. The invaluable technical outcome from the project would be a set of benchmark test cases that could be freely published and used by others to validate computational methods. The final outcome is the published validation of the CSIRO SPH code for wave-structure interactions and its application to a case of real world interest.

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

1. A Bachelors Degree in Mechanical/Chemical/Civil Engineering with a High Distinction or equivalent from a reputable (IIT or equivalent) institute in India or a Masters Degree in Mechanical/Chemical/Civil/Ocean Engineering from a reputable institute in India.
2. Relevant courses in Fluid Mechanics and/or Ocean Engineering with evidence of performance at the highest level.
3. Demonstrable excellent oral/written communication skills in English.
4. Relevant skills in programming in a computer language.

Desirable:

1. Ability to fluently program in Fortran/C/C++ and good debugging skills.
2. TOEFL or IELTS scores to demonstrate English language proficiency.
3. Previous experience with experimental setup methods for fluid mechanics.
4. Conference/journal publications.