APPLIED MATHEMATICS DIVISION

MODELLING AND SIMULATION OF FLOW PROCESSES

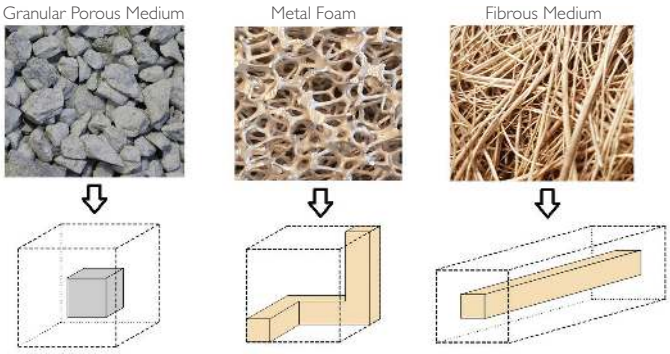
Predicting flow through porous structures

Geometric models resembling different types of porous media are continuously adapted and the analytical modelling procedures improved for predicting flow through porous structures that are used in a wide variety of industrial applications.

Applications include:

- Predicting the permeability of fibrous air filters
- Predicting pressure drops in biofilters
- Modelling the initiation of motion of muds and shells

Geometric Models Representative of Average Medium Geometry

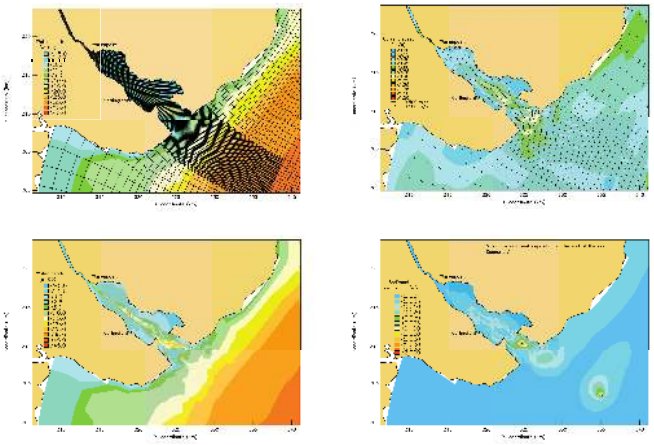


MODELLING OF HYDRODYNAMIC PROCESSES IN COASTAL SYSTEMS

The hydrodynamic and physical processes that govern transport in estuarine and coastal systems as well as the interaction of waves with porous structures are investigated by different means such as theoretical treatise, experimentation and simulations.

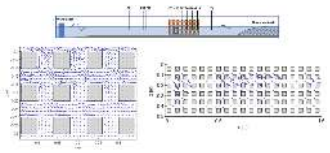
Applications include:

- Temperature and density variations in Table Bay and False Bay
- Sediment transport and sea bed changes in Carlingford Lough and the Port of Mombasa
- The movement of waves through porous breakwaters



The 30 metre long wave flume

Detailed and average velocities in the porous medium



COMPUTATIONAL MECHANICS

Computational mechanics is an interdisciplinary approach that uses computational methods to solve phenomena governed by the principles of mechanics.

This process follows the following steps:

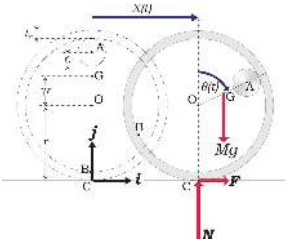
1. A mathematical model is developed and expressed in terms of partial differential equations.
2. Finite differences or finite elements are employed to discretize the equations.
3. The problem is coded and solved.
4. The solution is compared to experimental results for validation.

The applications investigated in our division includes:

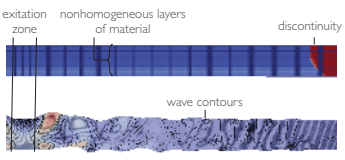
- Rigid body dynamics
- Modelling of non-linear and anisotropic materials
- Fluid-Structure interaction
- Waves propagating through non-homogenous elastic media
- Multiscale phenomena
- Growth of organisms in different mechanical environments

Blood flowing through fistula

Loaded hoop



Waves propagating through elastic media



Phase diagram of loaded hoop