

# Overview of NUIM Wave Energy Group Activities

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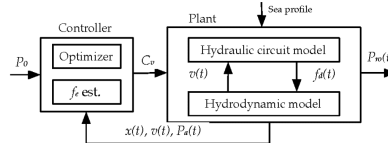
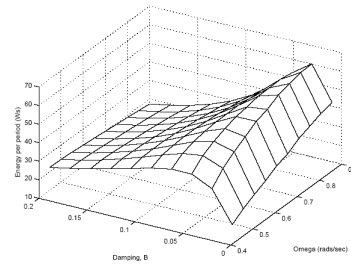
## Talk Outline

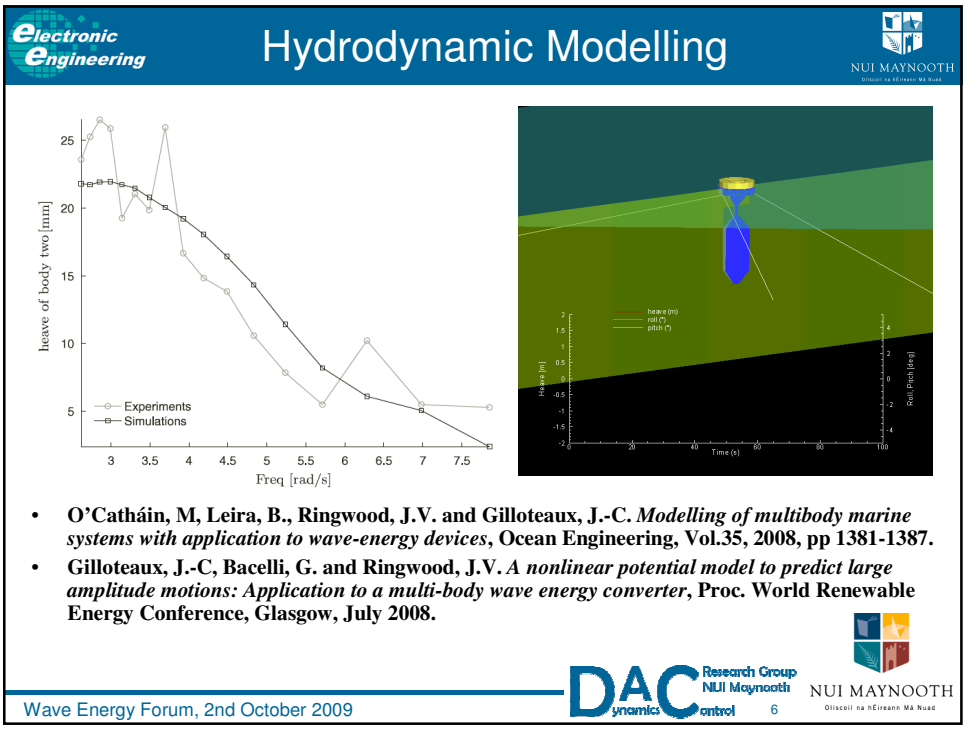
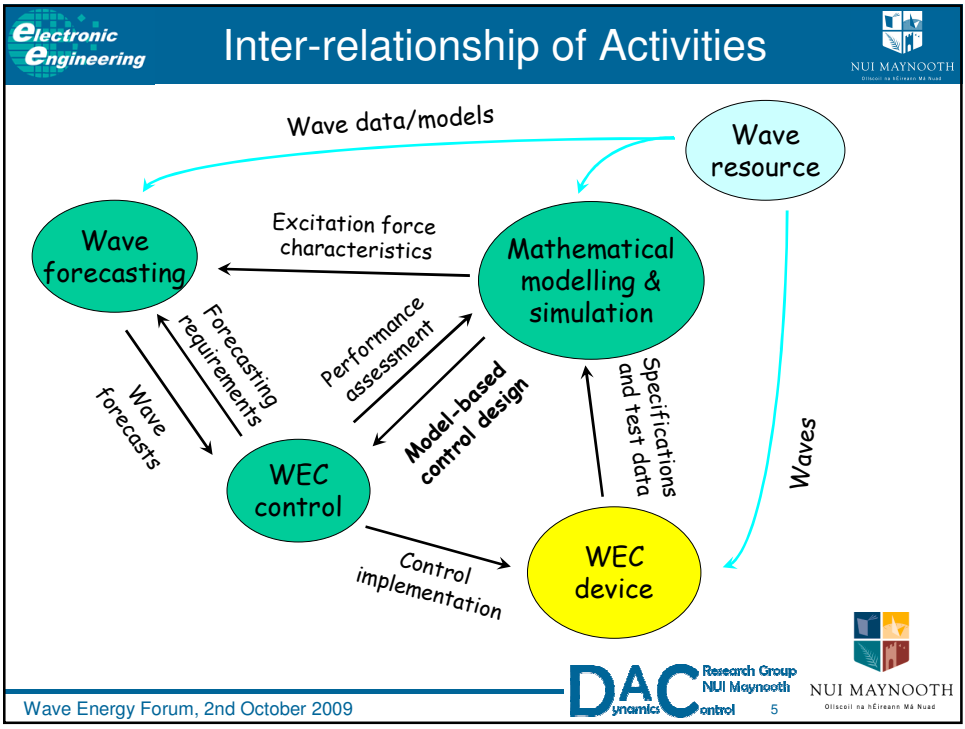
- NUIM Wave Energy Group overview
- Group areas of expertise
- Interrelationship of activities
- Sample results
  - Mathematical modelling (hydrodynamics, PTO)
  - Pressure control for potable water production
  - Resource assessment and forecasting
  - Wave directionality
  - Geometric optimisation

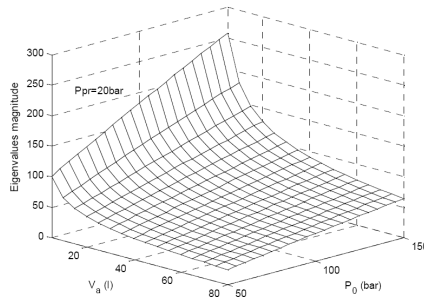
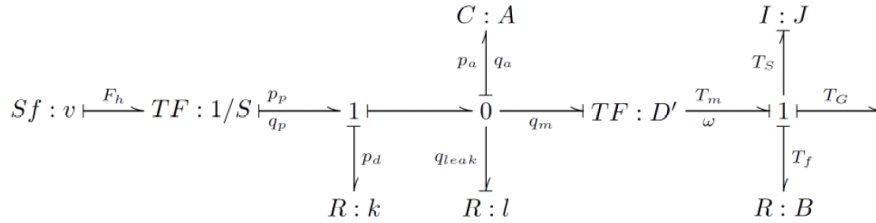
- Group background in math. modelling, forecasting, control design.
- Currently:
  - 1 PI (self)
  - 1 postdoc
  - 3 research students
  - Currently recruiting 1 postdoc + 3 research students
- Current funding includes: Industrial, EI, IRCSET
- Collaboration with
  - Industry (Wavebob, OES, Wavestar)
  - Academic (Nantes, HMRC, UL, LUREG)



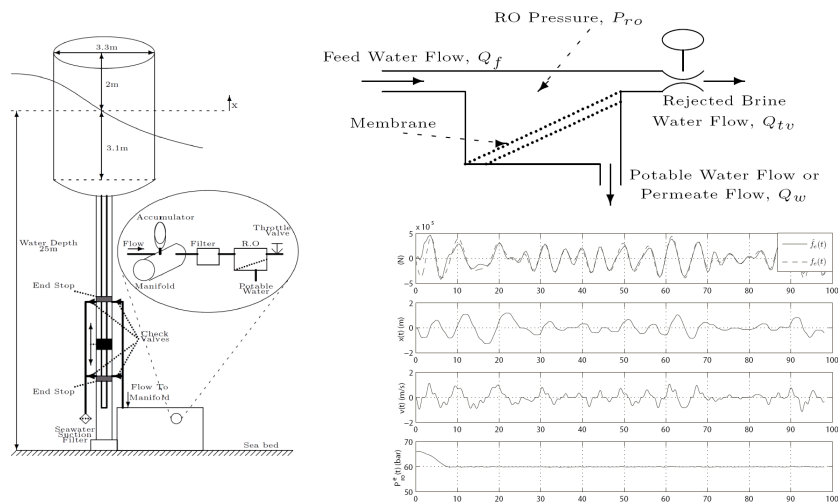
- Hydrodynamic modelling
  - Single body
  - Multibody
  - Arrays of devices (new project)
- PTO modelling
  - Mechanical, electrical, hydraulic components
- Impact of wave directionality on WECs
- Device optimisation
  - Geometric optimisation
  - Optimisation in the presence of control
  - Total economic optimisation (new project)
- Control system design for WECs
  - Real-time calculation of optimal damping force
  - Control for electricity production
  - Control for potable water production
  - Control of arrays of devices (new project)
- Resource assessment and forecasting
  - Forecasting of free surface elevation
  - Forecasting of excitation force
  - Assessment of combined wind/wave resource



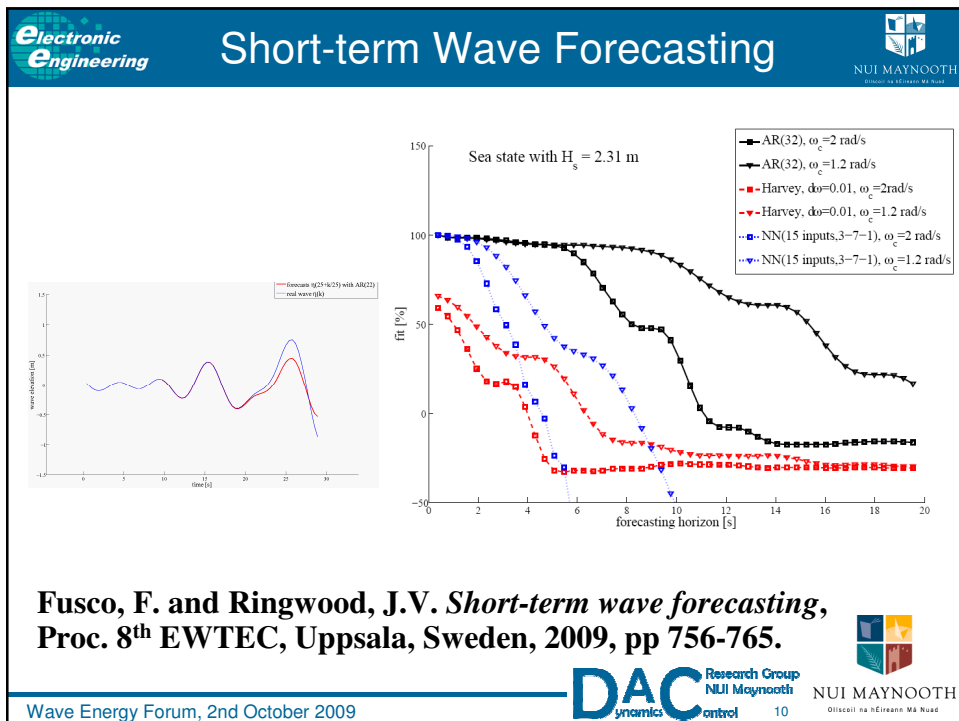
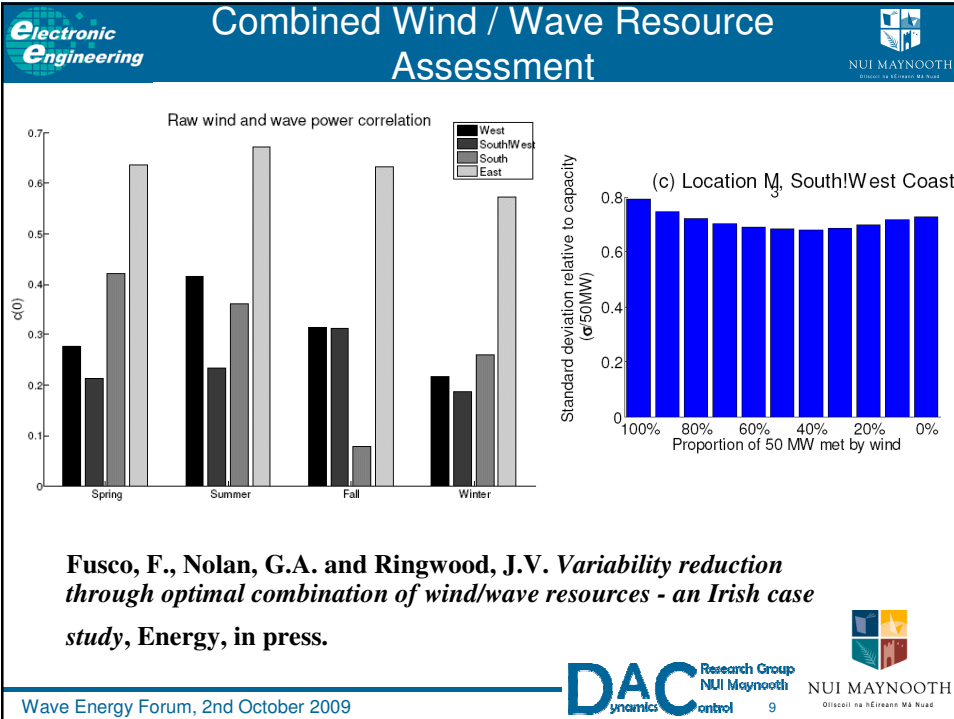


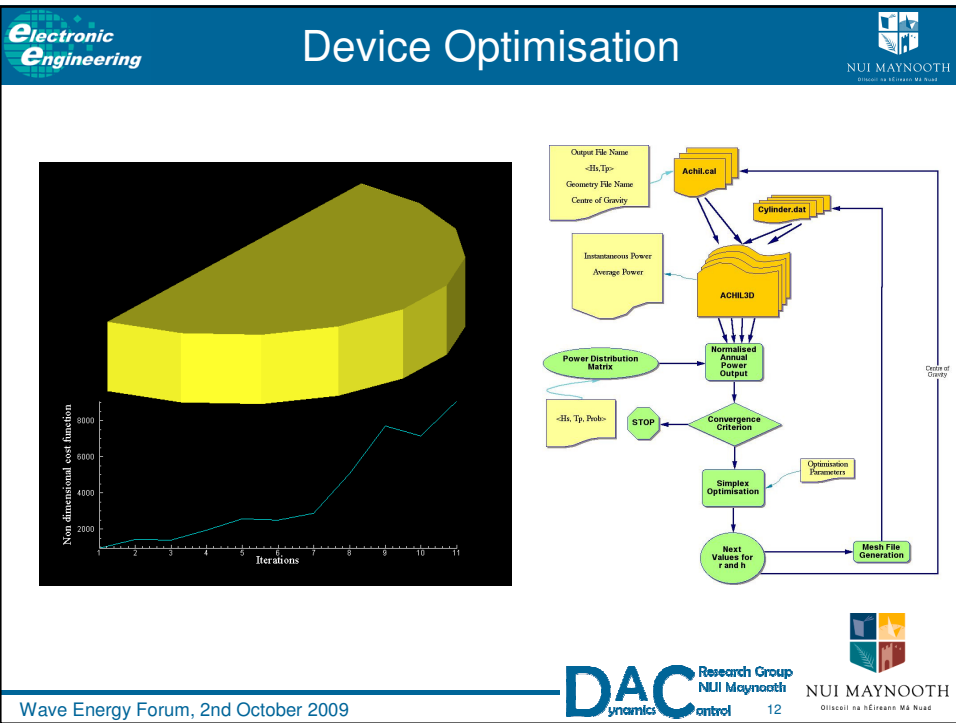
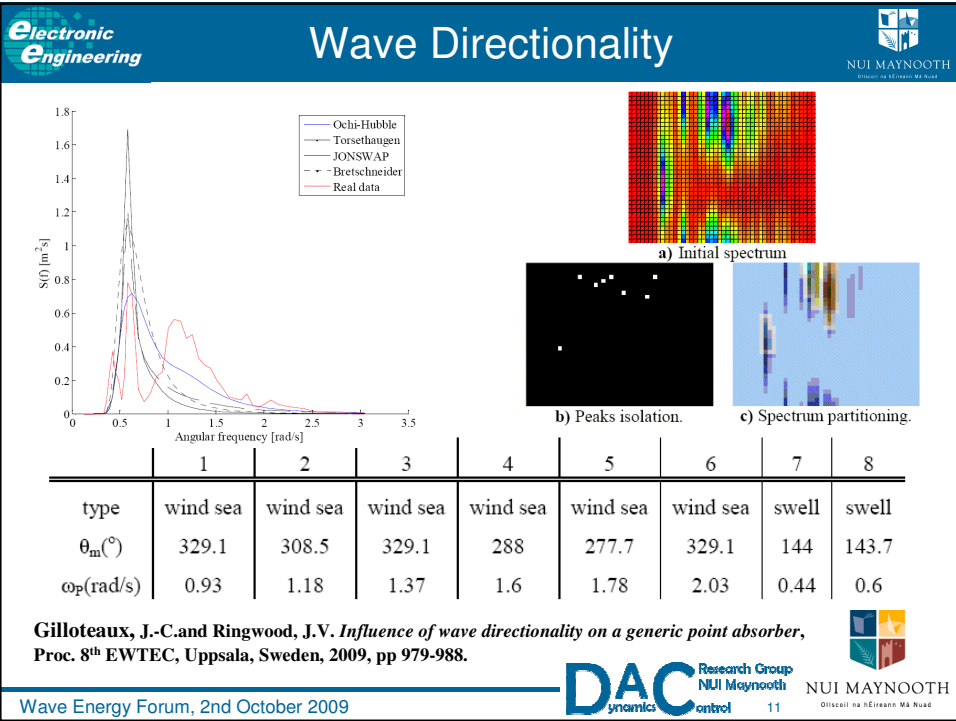


**Bacelli, G., Gilloteaux, J.-C. and Ringwood, J.V. State space model of a hydraulic power take off unit for wave energy conversion employing bondgraphs, Proc. World Renewable Energy Conference, Glasgow, July 2008.**



**Bacelli, G., Ringwood, J.V. and Gilloteaux, J.-C. Control of a wave energy device for potable water production, Proc. European Control Conf. , August 2009, pp 3755-3760.**





- Selection of results/expertise available
  - Math. modelling/simulation
  - Some control results (e.g. potable water production)
  - Not always easily applicable due to diversity of wave energy devices !
- Plenty of fundamental work still required:
  - Real-time optimal control solutions
  - Modelling and control of arrays of devices
  - Geometric and economic optimisation