

The Use of Compliant and Continuous Structures in the Nearshore Environment for the Purpose of Wave Energy Extraction

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Introduction

A modular, flap-type wave energy converter is being investigated. This is a device made up of individual flap modules that share a common foundation. The structure would be compliant due to the independence of each module. The hydrodynamic performance and foundation loading of the device are being assessed and compared to that of an equivalent rigid flap (Fig. 1). Key variables will be the widths of the modules and devices.

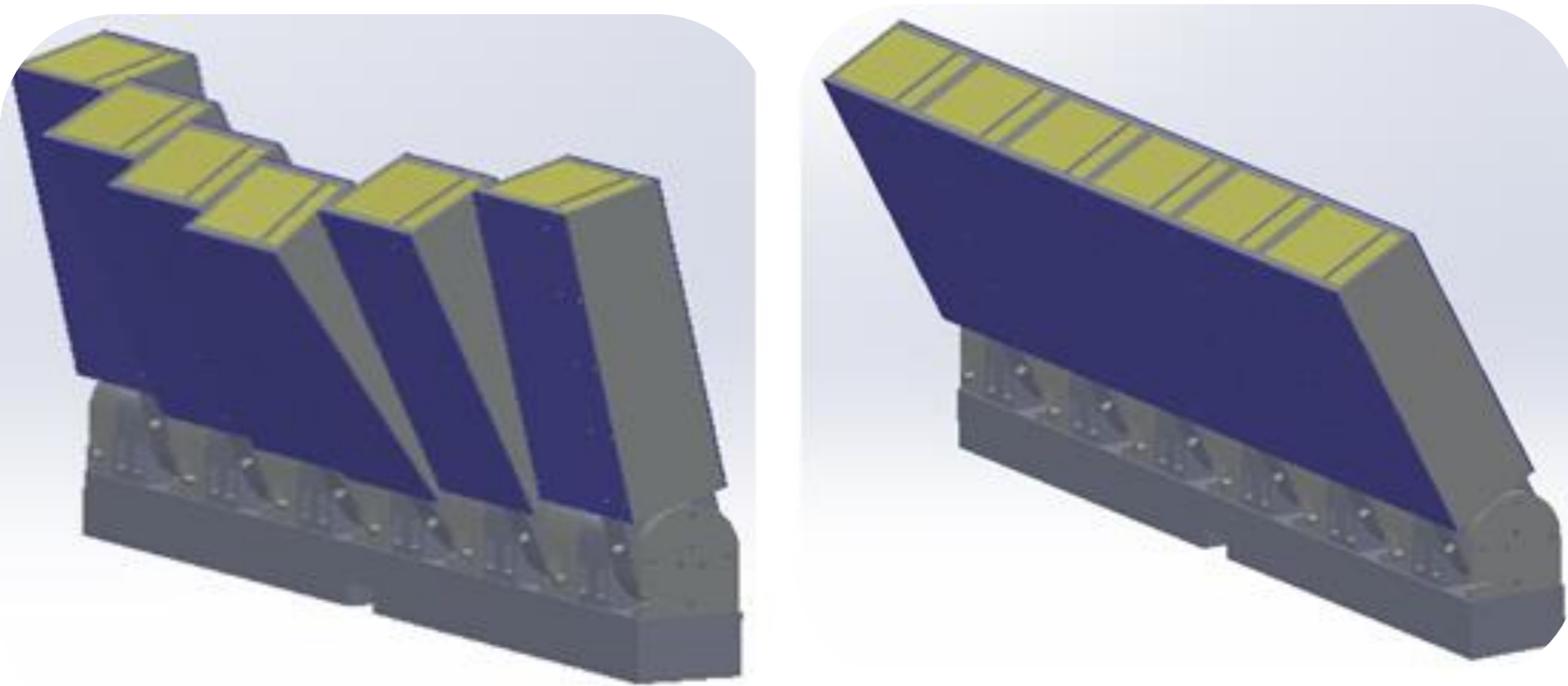


Figure 1. Modular flap (left) and rigid flap (right)

Motivation

A modular flap could have:

- increased capture factor and/or reduced loads
- more cost-effective manufacturing and installation
- increased PTO redundancy, but also complexity

Methodology

Physical Modelling:

- Testing in Queen's University Belfast (QUB) wave tanks (Fig. 2-3).



Figure 2. Generating off-angle waves in Portaferry wave tank



Figure 3. Undamped tests on foundation loading ⁽¹⁾

Numerical Modelling:

- Time-domain model has been developed to expand ranges of variables, e.g. geometry and wave climate.
- Model to be calibrated and validated with physical model results.

Progress

Physical Modelling:

- Fully instrumented 30th scale model fabricated and assembled. Design available in (2).
- Model design verified in Belfast wave tank (Fig. 4).
- Preparation almost complete for Portaferry tests (Fig. 5).

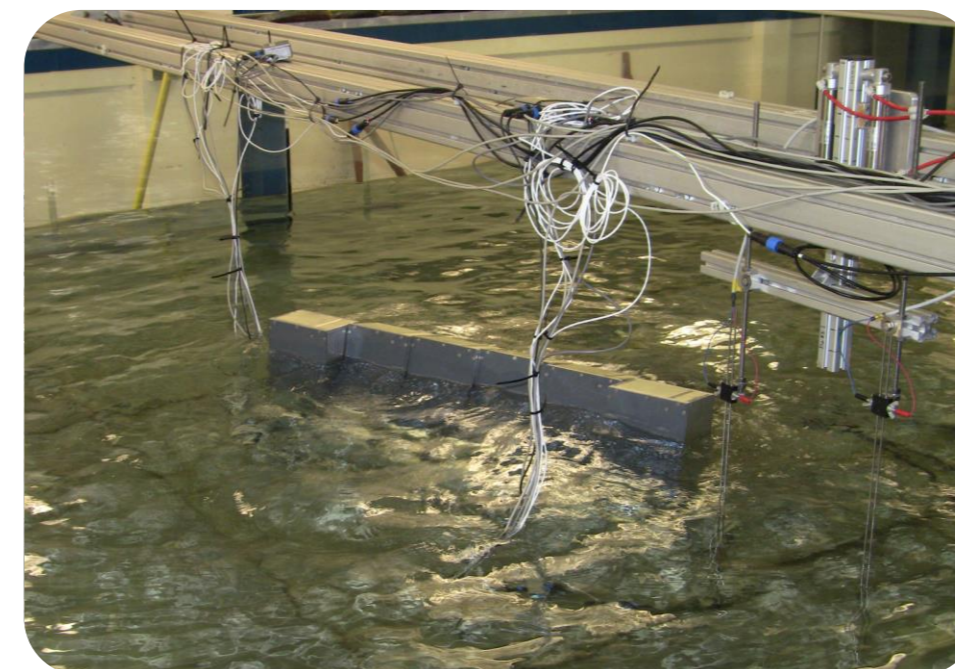


Figure 4. Fully instrumented model in Belfast wave tank



Figure 5. Data acquisition system developed for Portaferry wave tank

Numerical Modelling:

- Array model ⁽³⁾ adapted for modular flap.
- Preliminary results produced (Fig. 6).

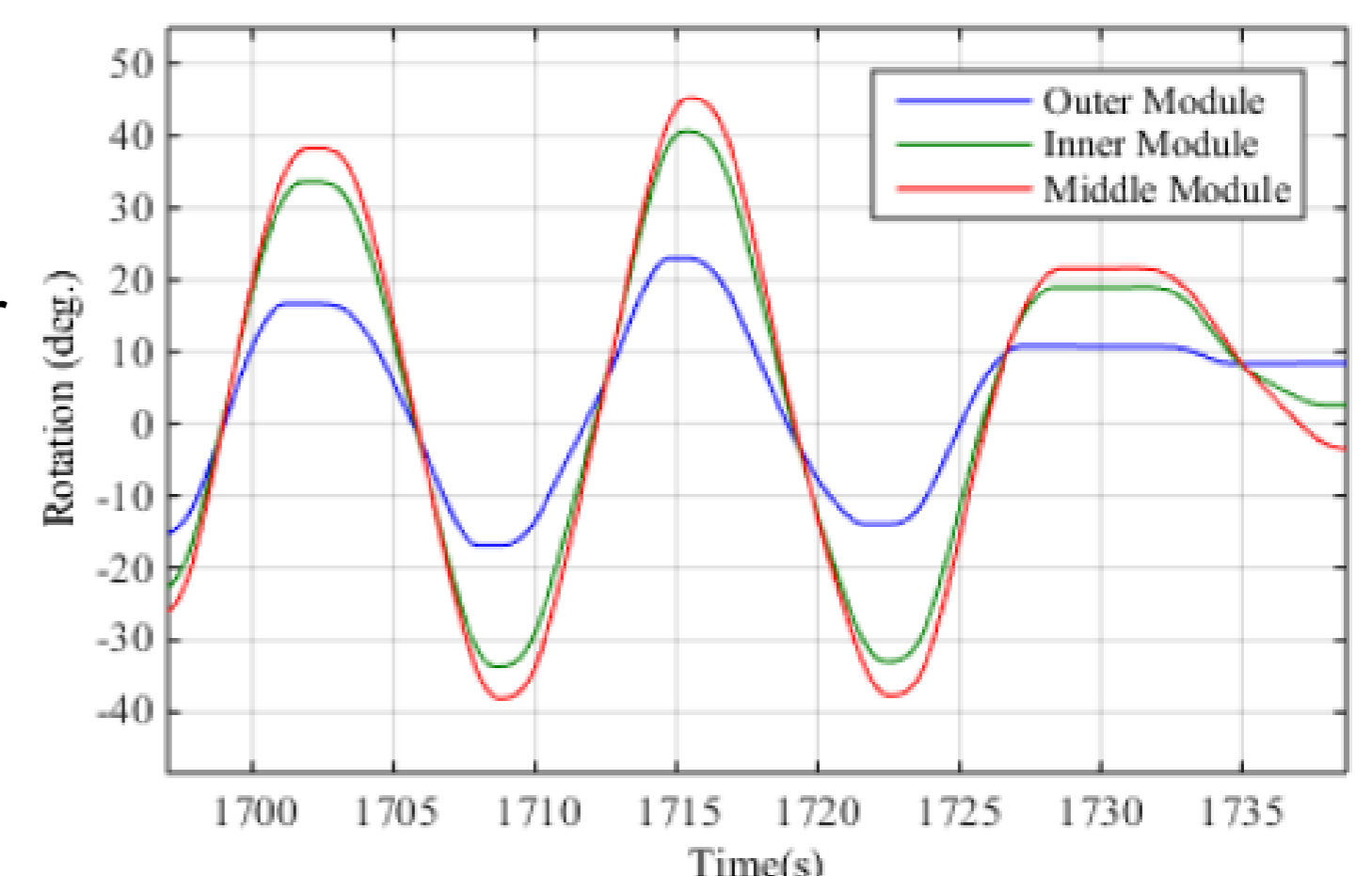


Figure 6. Time-series of module rotations

References

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