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Energy

Quantifying the influence of sea state parameters over WEC performances

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Introduction

Background: Numerous wave energy converters have been thoroughly tested numerically and experimentally. However, little is still known about the influence of many directional seastate parameters over their performances, and wave climate are often reduce to H,T scatter diagrams .

Plan of studies: This PhD focuses on experimental testing of a few WEC models in the Edinburgh Curved Tank against a comprehensive set of parameters. Its main objective is to evaluate the common practice of using H,T scatter diagrams for performance prediction.

This project is on its first stage, where effort are put into developing a highly precise method to generate and measure 3D directional spectra in the wave tank. This poster presents the current work and results on this topic.

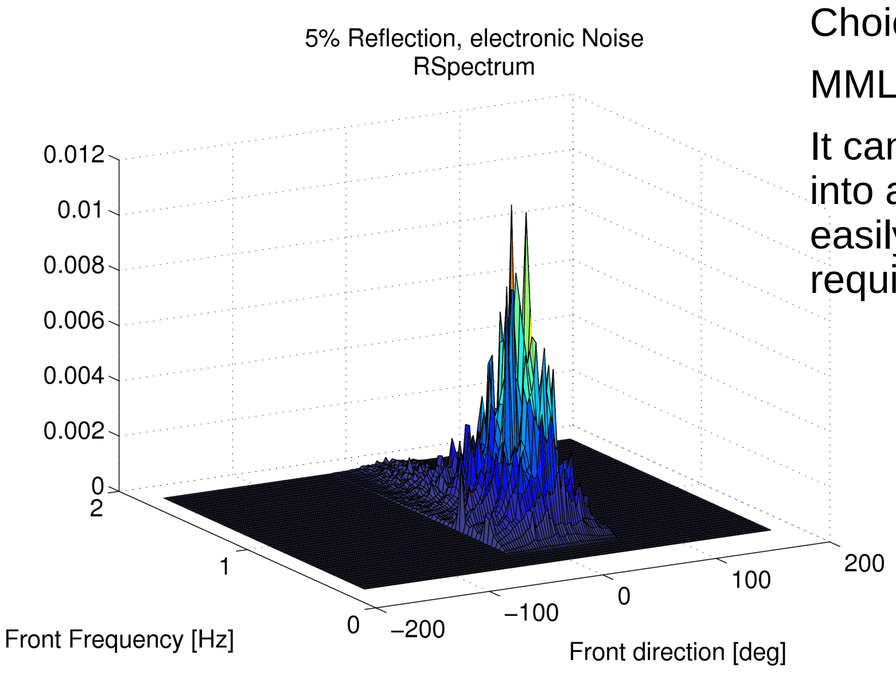
Adapting the MMLM method to deterministic waves.

Methods to estimate the wave directional spectra have been developed for random waves.

Waves generated in the Edinburgh Curved Tank: periodic, pseudo-random. Known directions of propagation and frequencies.

⇩

Need to adapt existing method to use these characteristics and get better precision.



Choice of method:

MMLM [1].

It can take reflection into account and be easily adapted to the requirements.

Current status:
satisfactory results over virtual data including noise and reflection from one reflector.

Measuring the wave angles.

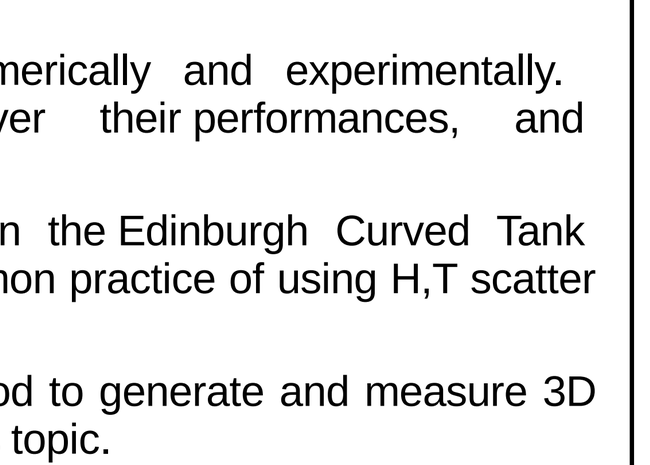
Early ideas about the MMLM adaptation was to use the pre-knowledge of the wave angle of propagation. This requires a tank generating wave at very precise angle: acceptable error <1°

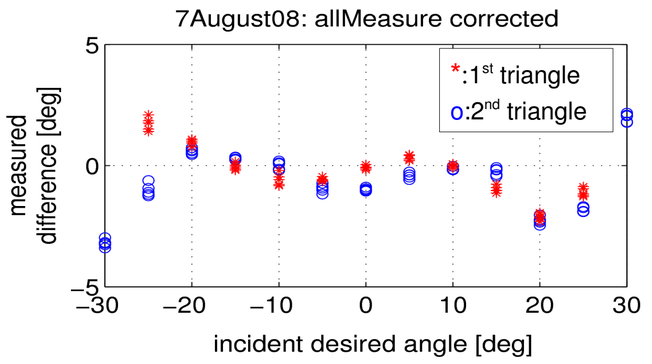
⇒ Adaptation of a *PTPD* [2] model to measure the tank accuracy

Mapple estimation of the method precision.

Using 3 probes, a precision of ≈2° is reached for waves travelling at low angles.

To compensate the lack of precision, the measures are repeated and 2 set of 3 probes is used





Results of measurements:

The tank is accurate enough in the [-20°;+20°] range.

Out of this, reflection on the glass and dissipation affect the accuracy.

Conclusion:
Beside the tank good performance in the [-20°;+20°] range, it is not possible to use the previous knowledge of the wave directions to increase the MMLM precision.

•What comes next:

• Finishes the development of a method to measure 3D-Spectra in the tank based on the MMLM and taking into account reflection from 2 reflectors.

• Planning the tests according to “Design of Experiments” methods.

• Experimenting and analysing the results

References

[1] Isobe, M. & Kondo, K. Method for estimating directional wave spectrum in incident and reflected wave field, Coastal Engineering(1984), American Society of Civil Engineers, 1985, 467 – 4

[2] Fernandes, A.; Sarma, Y. & Menon, H. Directional spectrum of ocean waves from array measurements using phase/time/path difference methods Ocean Engineering, 2000, 27, 345-363

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