Non-Linear Feedback Control Applied to Marine Energy Collectors

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Work Stream 7: Advanced control of devices and network integration

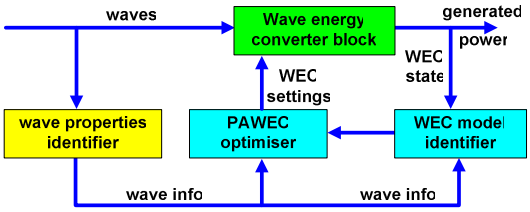
Introduction

WS7 examines the consequences of non-linearity of the marine resource on the MEC response and energy capture. One aim is to develop control algorithms that will mitigate the uncertainties due to resource non-linearity and that will ensure optimum power capture for all marine climates.

Details

Optimisation for non-linear waves is already the subject of research at Lancaster University. However, this type of optimisation requires high-performance low-level control of the device actuators in order to be effective.

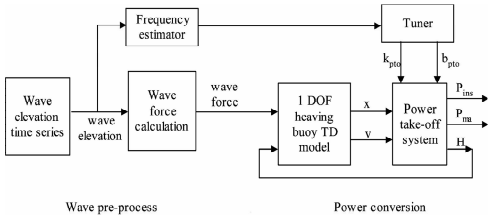
The aim of this project is to investigate the latest developments in non-linear feedback control applied to Marine Energy Collectors. In particular, a full state feedback approach to control system design based on both linear and state-dependent parameter methods will be developed.



Adaptive control technique outline

Using existing generic models supplied by the Edinburgh and Lancaster teams, supplemented where necessary by adding actuator components (e.g. a sliding mass model for PS Frog type devices), both linear and state-dependent parameter methods will be evaluated for non-linear wave inputs. The same (previously developed) starting point for the research and the research will provide co-benefits to existing optimisation research in WS7 by broadening its scope, opening doors on future possible lines of enquiry.

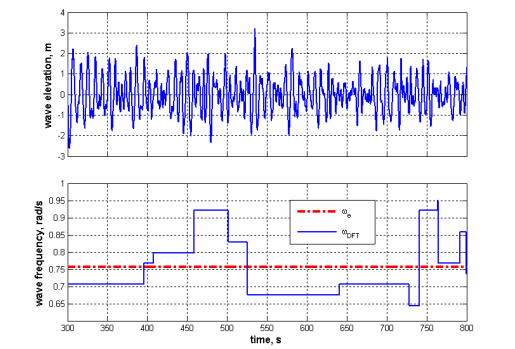
Any successful results that do emerge from the Lancaster or Edinburgh teams will be exploited. For example, using the outputs from the optimisation studies as (time varying) set points for the low-level control.



Overall model of the PAWEC system

This project will use time varying parameter methods for the identification of control models. Similar statistical methods have been successfully used for the analysis and forecasting of environmental time series data over many years.

Therefore, assuming the availability of suitable sea wave data, this research will make a contribution to wave characterisation and short term prediction. In particular, a novel dynamic auto-regression spectrum (a time-varying frequency domain graph) will be investigated.



Estimation of wave frequency

Lancaster University
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