WECCCOMP

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The Wave Energy Converter Control Competition

Indicative timescale:

- **1st Dec. 2017 -** Registration opens.
- **1st Sep. 2018 -** Entry deadline.
- **31st Oct. 2018 -** Shortlisting complete.
- **15th Nov. 2018** - Interactive implementation refinement.
- **31st Jan. 2019** - Implementation evaluation.
- **31st Mar. 2019 -** Final results published.

WEC-Sim model of device:

The device to be controlled is a leg of a Wavestar-like device, with one independent degree of freedom. A WEC-Sim model of the device has been prepared, with a link to the model on the WECCCOMP GitHub repository.

WEC-Sim is an open source code jointly developed by NREL and Sandia in MATLAB that is publicly available on the WEC-Sim GitHub repository. The WEC-Sim code requires the following MATLAB toolboxes: Simulink, Simscape, and Simscape Multibody. For more information about WEC-Sim, refer to the WEC-Sim website.

The WECCCOMP organisers have negotiated 25 temporary free licenses for competitors to use in developing and simulating their controllers. These will be distributed upon registration, on a first-come, first-served basis. Note that a maximum of one licence will be available to each group/institutional entry. These will be available upon registration.

Entering the competition

To enter the WECCComp competition, a registration form on the WECCCOMP website must be completed, notifying organiser of your intention to submit an entry. This will then give you access to the WEC-Sim device model, an opportunity to avail of the temporary Matlab licences, and access to post on the WECCCOMP forum.

Your entry (controller software + a brief description) must be received by 1st September 2018. No late submission will be accepted. Following evaluation in simulation, a shortlist of entries will be selected for evaluation in the wave tank.

Note that, in order to maximise the benefit to the wave energy community, the organisers plan to publish the results of the competition. Therefore, by entering the competition, competitors implicitly agree to publication of the results relating to their controllers.

Evaluation criteria

The following criterion will be used to evaluate the controllers:

$$\frac{\text{avg}(P)}{2 + \frac{|f|_{98}}{F_{max}} + \frac{|z|_{98}}{Z_{max}} - \frac{\text{avg}|P|}{|P|_{98}}}$$

where:

avg (P) is the average (electrical) absorbed power (in W)

$|f|_{98}$ is the 98th percentile of the absolute force time history (in N)

F_{max} is the force constraint on the PTO (60 N)

$|z|_{98}$ is the 98th percentile of the absolute displacement time history (in m)

Z_{max} is the displacement constraint on the PTO (0.08 m)

$|P|_{98}$ is the 98th percentile of the absolute electrical power time history (in W)

avg$|P|$ is the mean absolute electrical power (in W)

The mechanical-to-electrical efficiency of the linear motor PTO unit, η, has been set at 70%. The electrical power is post processed as follows:

$$P = \begin{cases} \eta P_a & P_a > 0 \\ P_a/\eta & P_a < 0 \end{cases}$$

where P is the linear motor electrical power (after inclusion of conversion efficiency) and P_a is the linear motor absorbed power (before inclusion of conversion efficiency). Please see the post processing calculation performed in the *userDefinedFunctions.m* file. The evaluation criteria will only be calculated for time > 25s (the first 25 seconds of simulation will be discarded for all sea states).

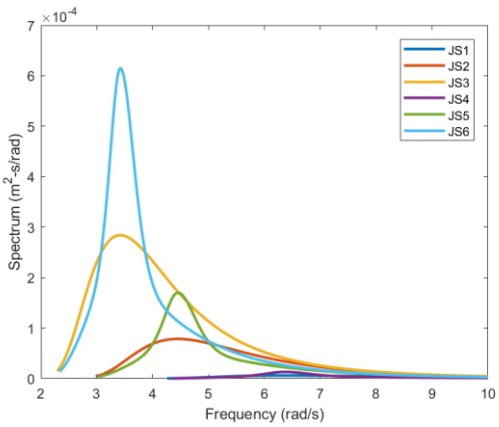
Operating conditions

For the purposes of the competition evaluation, a series of 6 wave states, using the JONSWAP spectrum, will be employed, as follows:

JONSWAP (JS) Spectra (Hm0, Tp , gamma)

s1 (0.0208, 0.988, 1)
s2 (0.0625, 1.412, 1)
s3 (0.1042, 1.836, 1)
s4 (0.0208, 0.988, 3.3)
s5 (0.0625, 1.412, 3.3)
s6 (0.1042, 1.836, 3.3)

A set of realisations for each sea state will be used, with randomised phases, to eliminate any statistical bias, but a consistent set of realisations will be used across entries, to ensure fairness of evaluation. In addition, two other sea states will be employed for checking purposes and may be published, but will not be included in the evaluation criteria. They are a narrow-banded sea state at resonance (to examine controller behaviour around device resonance) and a more extreme sea state than in s1 - s6 above.



Discussion fora

Two separate fora are available to handle/share queries and responses. The WECCCOMP forum deals with issues purely related to the competition, while the WEC-Sim forum is for all queries related to the WEC-Sim environment, since discussion on this topic will be of benefit to the wider WEC-Sim user community.

For further information, see the WECCCOMP website, the 2017 EWTEC paper describing the rationale behind the competition, or use the WECCCOMP forum!

Organisers