WEC-SIM STATUS REPORT

FY14 Q2

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PROJECT STATUS

The WEC-Sim project is currently on track, having met both NREL and SNL's FY14 Milestones to date, as shown in Table 1 and Table 2 respectively. Thus far in FY14, the WEC-Sim team demonstrated the WEC-Sim alpha code's functionality to DOE HQ through a webinar in October 2013. The WEC-Sim code has been applied to model two WECs; a heaving point absorber (RM3), and a pitching device (OSWEC). Results from these WEC-Sim simulations have been verified through a code-to-code comparison to the commercial codes WaveDyn, AQWA and OrcaFlex. Preliminary code validation has also been performed by comparing the WEC-Sim RM3 simulation results to experimental data from the reference model project. Three papers on WEC-Sim's code development have been submitted to OMAE 2014 for publication and presentation. Another paper is in progress for publication and presentation at GMREC 2014. The WEC-Sim project has been presented internationally at the IEA OES in November 2013, and within the US at the Water Power Peer Review in February 2014. Both presentations received favorable reviews and have sparked interest in the code. This resulted in a pre-release of the code to a limited user group in early March 2014. The WEC-Sim project is currently on schedule for the WEC-Sim code's public release in June 2014.

Table 1: NREL WEC-Sim Quarterly Milestones

NREL WEC-Sim Milestones	Due Date
WEC-Sim Modeling: Model a point absorber device in WEC-Sim. Verify the WEC-Sim results by comparing with experimental data from Berkeley/SCRIPPS wave tank tests performed as part of the Reference Model 3 Project, Wave-Dyn, and/or AQWA°. Upload the WEC-Sim model, results and a 1-2 page technical report summarizing the results to the WEC-Sim SharePoint website by December 31, 2013.	Q1 (12/31/13)
WEC-Sim Verification: Model a pitching device in WEC-Sim. Verify the WEC-Sim results by comparing with Wave-Dyn and/or AQWA°. Also, compare the results with available wave tank data (e.g., NWEI/WET-NZ and Oyster). Upload the WEC-Sim model and results to the WEC-Sim SharePoint website. A letter report that summarizes the objective, results, and findings of the verification work will also be uploaded to SharePoint. This task will be completed by March 31, 2014. **Coding Competition:** Work with TopCoder to release a mesh generation coding competition with the objective of developing meshing capabilities for the open-source BEM. This task will be completed by March 31, 2014.	Q2 (3/31/14)
WEC-Sim release: Release the beta version of WEC-Sim on the NREL, SNL, and OpenEI websites.	Q3 (6/30/14)
WEC-Sim Testing: Draft a test plan and determine device specifications for a pitching device wave tank validation tests. Upload the test plan and specifications to the SharePoint website by September 30, 2014.	Q4 (9/30/14)

Table 2: SNL- WEC-Sim Quarterly Milestones

SNL WEC-Sim Milestones	Due Date
WEC-Sim point absorber model: Model a point absorber device in WEC-Sim. Verify the WEC-Sim results by comparison with experimental data from Berkeley/SCRIPPS wave tank tests performed as part of the Reference Model 3 Project, Wave-Dyn, and/or AQWA. The WEC-Sim model and results will be uploaded to the WEC-Sim SharePoint website along with a tech memo on the quarter's accomplishments.	Q1 (12/31/13)
WEC-Sim pitching device model: Model a pitching device in WEC-Sim. Verify the WEC-Sim results by comparison with Wave-Dyn, and/or AQWA. Also compare the results with available wave tank data (e.g. NWEI/WET-NZ and Oyster). The WEC-Sim model and results will be uploaded to the WEC-Sim SharePoint website along with a tech memo on the quarter's accomplishments.	Q2 (3/31/14)
WEC-Sim release: Release the beta version of WEC-Sim on the NREL, SNL, and OpenEI websites.	Q3 (6/30/14)
WEC-Sim validation: Draft a test plan and determine device specifications for the pitching device wave tank validation tests. Upload the test plan and specifications to the SharePoint website.	Q4 (9/30/14)

RM3 POINT ABSORBER MODEL

GEOMETRY DEFINITION

The Reference Model 3 (RM3) device, a two-body heaving point absorber design, was chosen as the first application of WEC-Sim. While the WEC is free to move in all 6DOF in response to wave motion, power is only captured in the heave direction. The RM3 device was chosen to leverage a prior DOE funded project, and because the design has already been well characterized both numerically and experimentally as a result of the reference model project, it has relatively simple operating principles, and is representative of WECs currently pursued by the wave energy industry. It is a simple heaving two-body point absorber, consisting of a float and a spar-plate, the full-scale dimensions and mass properties of which are shown in Figure 1 and Table 3. It should be noted that there are several different versions of the RM3 geometry, due to the RM project's iterative design process. This RM3 geometry was chosen because it is the full-scale version of the 1:33 Froude scale device tested at Scripps Institute of Oceanography in San Diego from November 30th – December 2nd 2011. Accordingly, simulations of the RM3 geometry defined below performed by WEC-Sim and commercial codes can be directly compared to experimental data obtained through the reference model project.

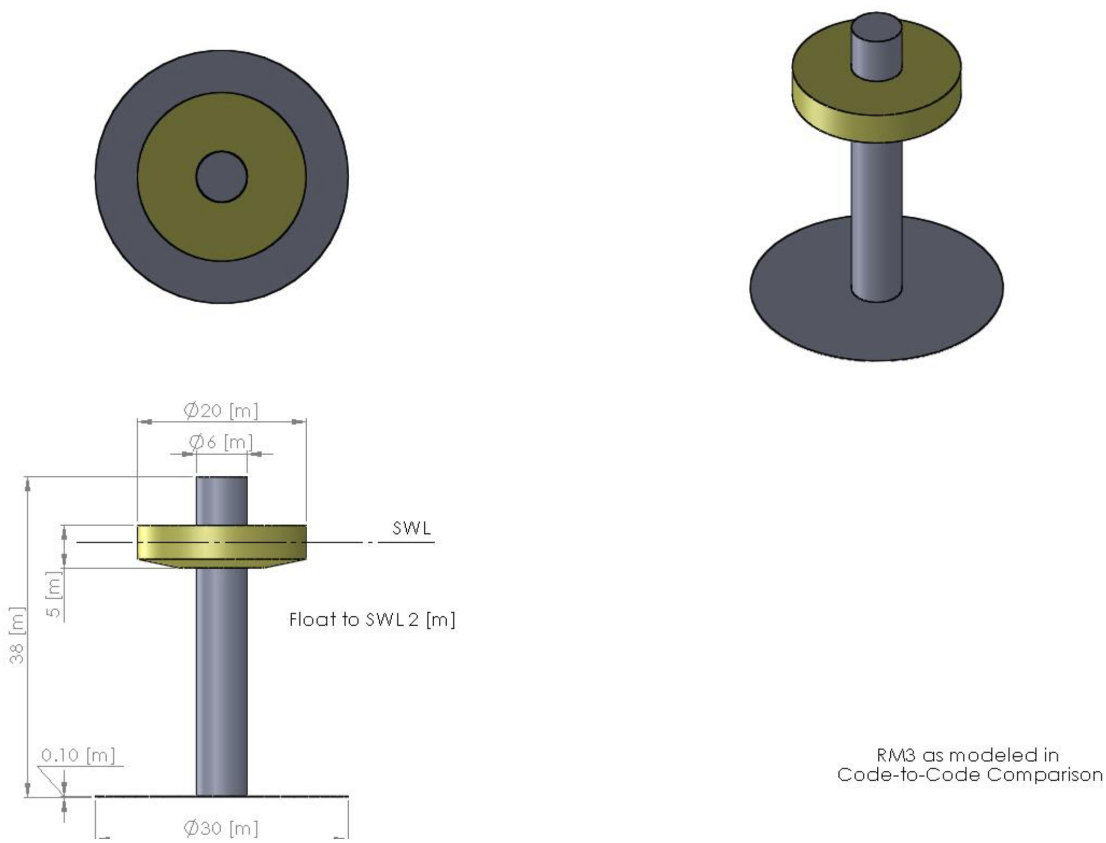


Figure 1. RM3 Heaving Two-Body Point Absorber Full-Scale Dimensions

Table 3. RM3 Heaving Two-Body Point Absorber Full-Scale Mass Properties

Float Full Scale Properties				
CG [m]	Mass [tonne]	Moment of Inertia [kg-m^2]		
0		20907301	0	0
0	727.01	0	21306090.7	4304.89323
-0.72105		0	4304.89323	37085481.1

Plate Full Scale Properties				
CG [m]	Mass [tonne]	Moment of Inertia [kg-m^2]		
0		94419614.6	0	0
0	878.30	0	94407091.2	217592.785
-21.285		0	217592.785	28542224.8

SIMULATION PARAMETERS

The parameters used in the simulations were based on the RM3 1:33 experimental setup from the Scripps wave tank test, as shown in Figure 2, and were the same for all simulations. The full-scale water depth, h = 1.5 [m]*33 = 49.5 [m], and the fluid density is that of water, ρ = 1000 [kg/m^3] (not that of salt water). RM3 simulations were run for representative regular operational waves of a constant wave height, H = 2.5 [m], and for wave periods, T = 8 [s] and 12 [s].

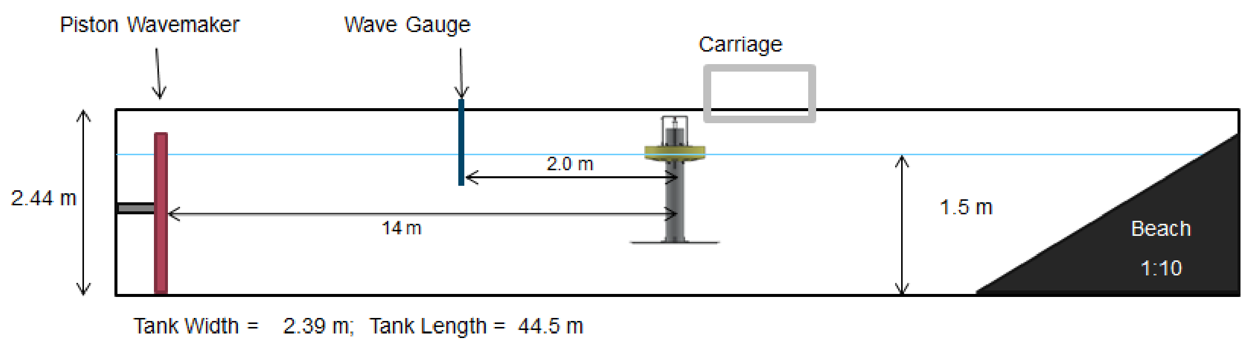


Figure 2. RM3 1:33 Scale Wave Tank Setup

WEC-SIM VERIFICATION

In order to verify the functionality of the alpha version of WEC-Sim, a code-to-code comparison was performed, where the RM3 point absorber described above was simulated in WEC-Sim, and compared to simulations of the same device using the commercial codes WaveDyn (Garrad Hassan) , AQWA (ANSYS) and OrcaFlex (Orcina). The RM3 point absorber was first modeled in 1DOF (heave only) in WEC-Sim, WaveDyn and AQWA. Then, the RM3 point absorber was modeled in 3DOF (heave, pitch and surge) in WEC-Sim, AQWA and OrcaFlex. In the following subsections, results from the code-to-code comparison for both the 1DOF and 3DOF simulations are shown.

1DOF CODE-TO-CODE COMPARISON

The first verification effort for WEC-Sim was performed by modeling the RM3 point absorber in 1DOF (heave only) using the alpha version of SNL/NREL developed code WEC-Sim, and comparing its results to the commercial codes WaveDyn and AQWA. All three codes were run for regular waves with T = 8 [s] and H = 2.5 [m], where the WEC motion was restricted to heave motion only, and did not include any motion due to coupled DOFs. Simulations were performed for the 1DOF code-to-code comparison with no PTO damping, and for PTO damping = 1200 [kN-s/m] between the float and plate. The full time-series figures show the overall trends in the WEC heave response, and show the different ramping functions for each of the models. WaveDyn uses a simple linear ramping function, whereas WEC-Sim uses a hyperbolic tangent function, and AQWA uses a $\sin^2$ function.

WITHOUT PTO DAMPING

Results from the regular wave simulation without PTO damping for the float response, shown in Figure 3 have very good agreement in terms of both the amplitude and phase between all three codes. For the plate response, results from the regular wave simulation, shown in Figure 4 have very good agreement especially between WaveDyn and AQWA, with an approximately 0.02 [m] difference with the WEC-Sim results. Since the WEC's power performance is a function of the relative motion between the float and the plate, this is a very important metric to gauge overall code performance. As shown in Figure 5, the relative heave motion shows very good agreement in terms of both the amplitude and phase for all three codes, which is very promising.

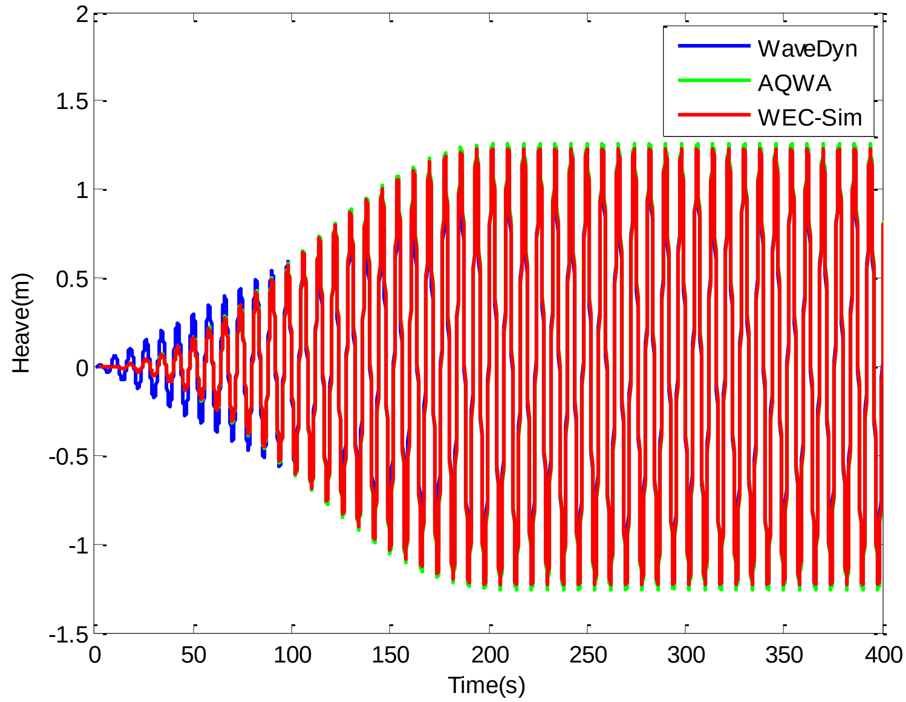


Figure 3. RM3 Float Heave Response for with H=2.5 [m] and T = 8 [s] and 0 [kN-s/m]

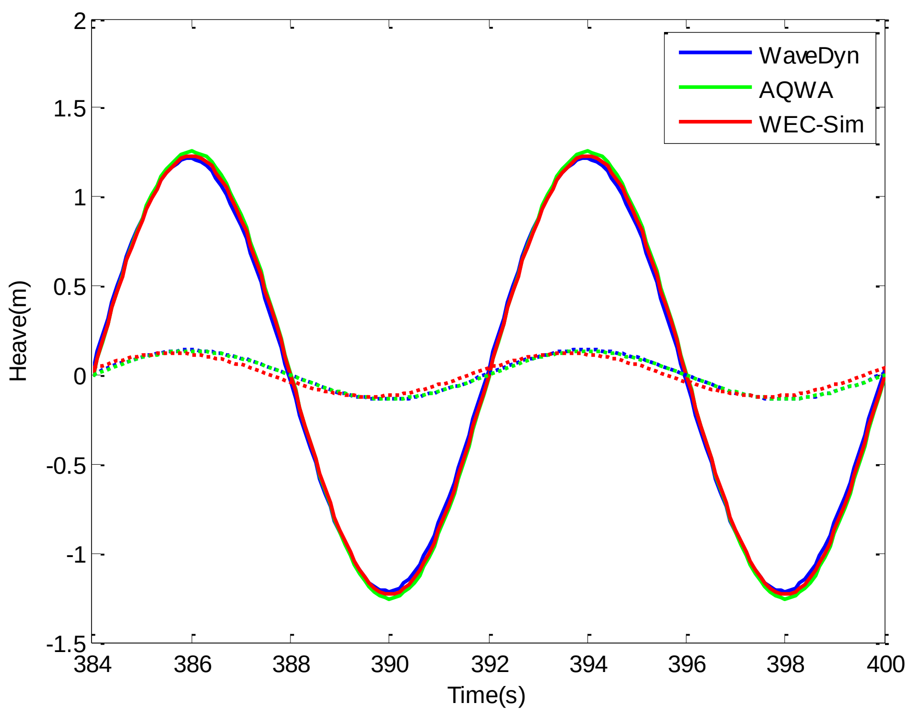


Figure 4. RM3 Float (solid) and Plate (dotted) Heave Response with H=2.5 [m] and T = 8 [s] and 0 [kN-s/m] zoomed in for the few wave periods

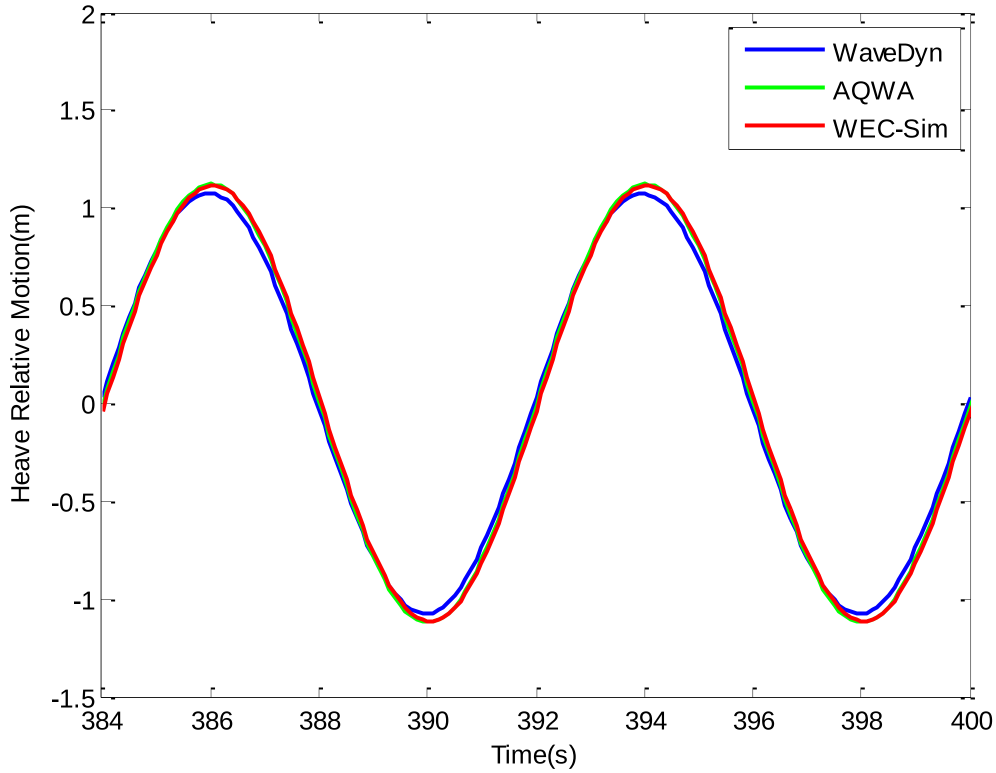


Figure 5. RM3 Relative Heave Motion with H=2.5 [m] and T = 8 [s] and 0 [kN-s/m] for the last few wave periods

WITH PTO DAMPING

Results from the regular wave simulations with PTO damping = 1200 [kN-s/m] for the float response, shown in Figure 6 have very good agreement in terms of both the amplitude and phase between all three codes. The plate response, shown in Figure 7, has fairly good agreement, with minor differences in amplitude response of approximately 0.04 [m]. The WEC-Sim and WaveDyn results have very good phase agreement, while the AQWA result is slightly shifted. This is an artifact of how AQWA models the PTO damping, because it does not allow for damping between bodies in relative translational motion, instead an external damping value must be applied to each individual body. As a result, the float and plate's response are not phase locked, and there is a phase shift for the plate response in the AQWA simulations. Since the WEC's power performance is a function of the relative motion between the float and the plate, this is a very important metric to gauge overall code performance. As shown in Figure 8, the relative heave motion shows very good agreement in terms of both the amplitude and phase for all three codes, which is very promising.

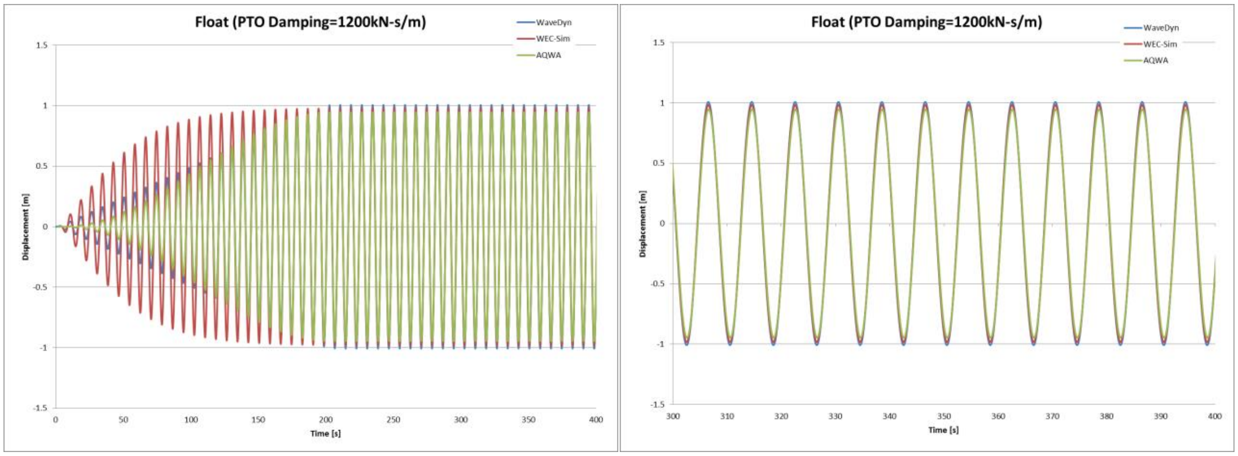


Figure 6. RM3 Float Heave Response: WEC-Sim, WaveDyn, and AQWA with H=2.5 [m] and T = 8 [s] and 1200 [kN-s/m] PTO damping for the full time series (left) and zoomed in for the last 100 [s] (right)

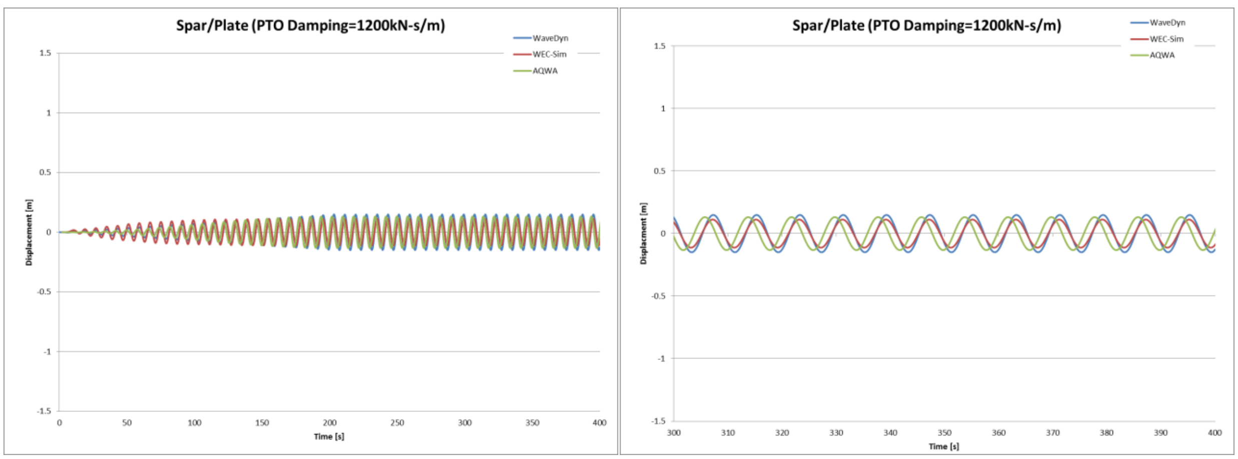


Figure 7. RM3 Plate Heave Response: WEC-Sim, WaveDyn, and AQWA with H=2.5 [m] and T = 8 [s] and 1200 [kN-s/m] PTO damping for the full time series (left) and zoomed in for the last 100 [s] (right)

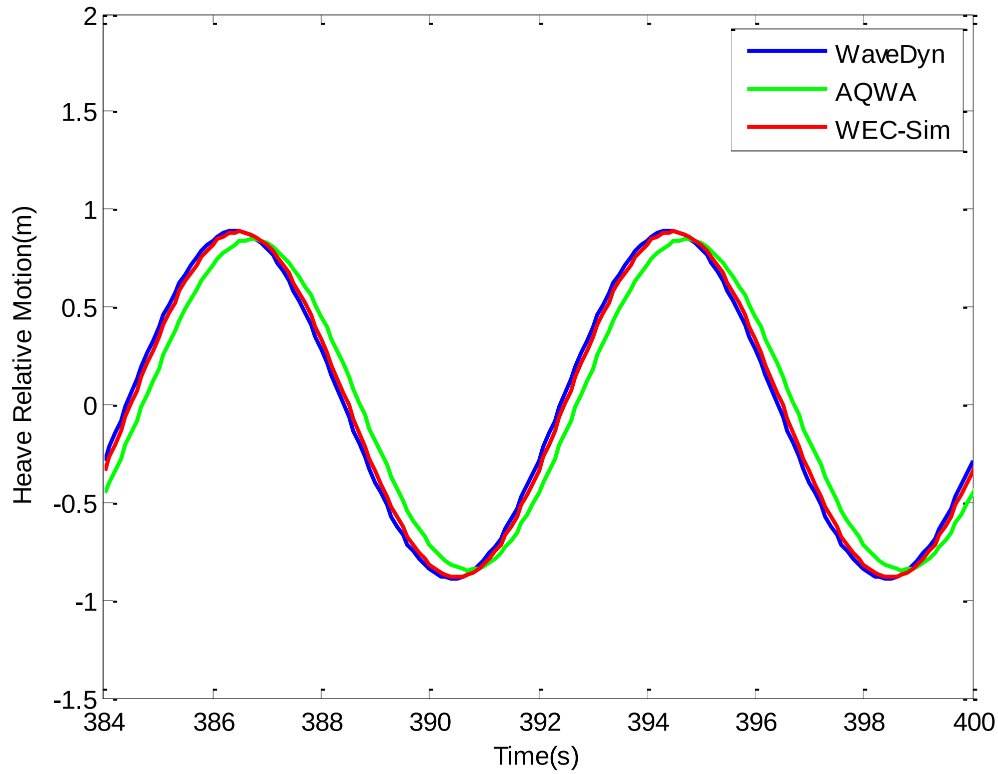


Figure 8. RM3 Relative Heave Motion with H=2.5 [m] and T = 8 [s] and 1200 [kN-s/m] PTO damping for the last few wave periods.

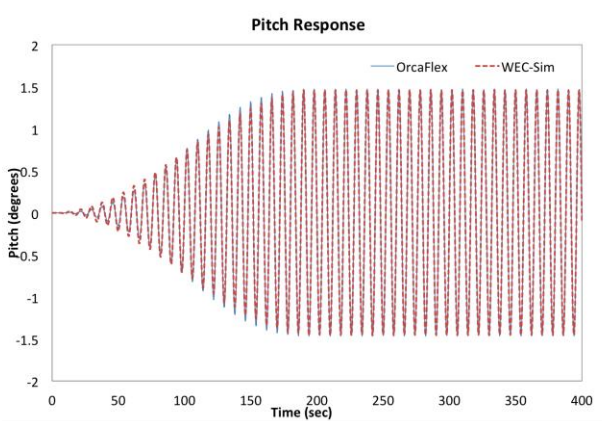
1DOF CODE-TO-CODE DISCUSSION

The WEC-Sim team is very pleased with the results from the code-to-code comparison for the 1DOF RM3 device, and views this effort as significant progress in the overall code development effort. The very slight discrepancy between the WaveDyn, AQWA, and WEC-Sim results may be explained by the fact that WaveDyn includes additional hydrodynamic terms in the equation of motion that represent the interaction between multiple bodies (e.g., added mass term from other body). The effect of these terms was small for the two-body point absorber, as expected, since the plate is deep in the water and far away from the float. Nevertheless, these additional terms could be important when modeling multiple-body WEC designs (e.g., CPT's SeaRay and StingRay designs), where different bodies are placed close to each other. Differences in the AQWA results for the PTO damped case can be explained by AQWA's inability to define damping between two bodies in relative translational motion.

3DOF CODE-TO-CODE COMPARISON

To further verify WEC-Sim, the WEC-Sim team also performed simulations in 3DOF, where the device was allowed to move freely in heave, surge and pitch. The simulation from the alpha version of WEC-Sim was compared to results from OrcaFlex and AQWA. In the OrcaFlex simulation, the float and the plate were modeled as two separate vessels connected with a spring-damper link, which contained infinite bending stiffness so that the float was only allowed to move along the spar. Because OrcaFlex only accepts single body WAMIT hydrodynamic coefficients for each body, the WEC-Sim code was modified so that the two codes used exactly the same WAMIT hydrodynamic coefficients and simulate the problem in exactly the same way. In the AQWA simulation, the float and plate were modeled in 3DOF with no relative constraints on motion between the bodies, due to AQWA's inability to define translational 'joints'. As a result, the AQWA surge and pitch results are irrelevant, but the 3DOF heave response is valid because it accounts coupling between DOFs for each body.

The analysis was conducted with regular waves, for wave height, H = 2.5 [m], and for wave periods, T = 8 [s] and 12 [s]. The time history of the device pitch response and the relative motion between the float and the plate obtained from WEC-Sim and OrcaFlex were compared, results of which are plotted in Figure 9, Figure 11 and Figure 11. A half cosine ramp function, which was similar to the one used in OrcaFlex was applied in WEC-Sim to slowly start the simulations in order to minimize the transient response. Results from WEC-Sim 3DOF simulation agreed very well with those obtained from OrcaFlex and AQWA.



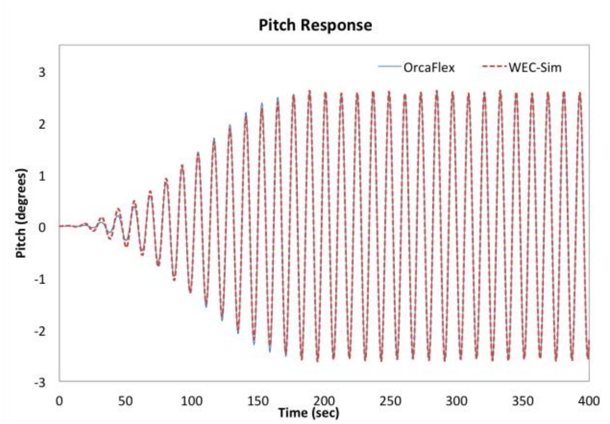


Figure 9. RM3 float pitch response from WEC-Sim and OrcaFlex with incoming wave period, T = 8 [s] (left) and 12 [s] (right)

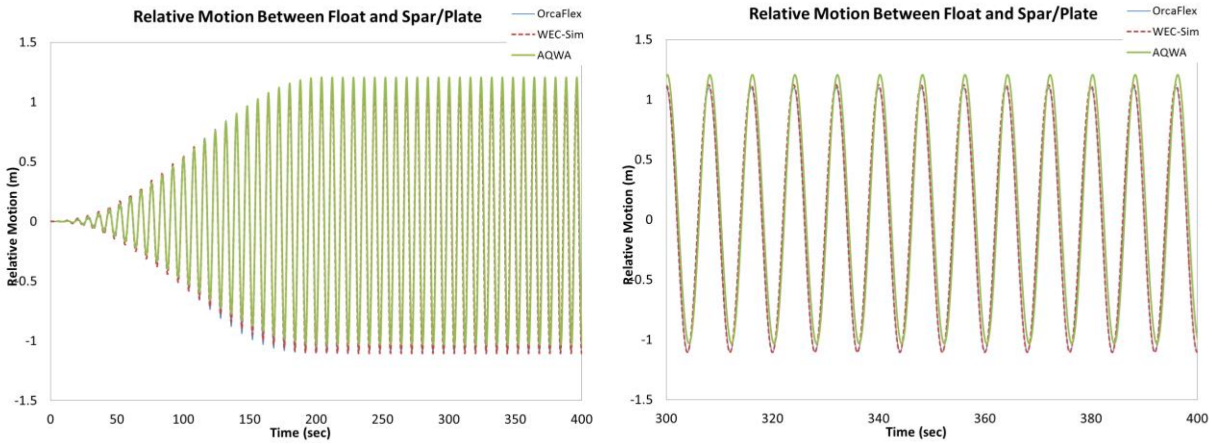


Figure 10. Relative Heave motion between the float and the plate from WEC-Sim, AQWA and OrcaFlex with H=2.5 [m] and T = 8 [s] for the full time series (left) and zoomed in for the last 100 [s] (right)

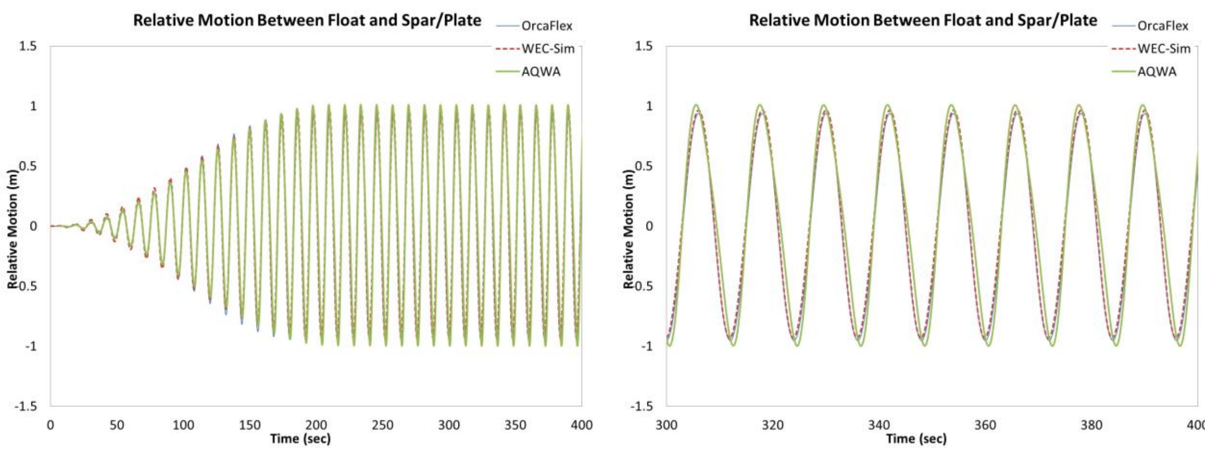


Figure 11. Relative Heave Motion between the float and the plate from WEC-Sim, AQWA and OrcaFlex with H=2.5 [m] and T = 12 [s] for the full time series (left) and zoomed in for the last 100 [s] (right)

3DOF CODE-TO-CODE DISCUSSION

In the simulation, mooring connections were not incorporated to constrain the device surge motion. No restoring stiffness or additional damping term was implemented in the surge equation of motion, except surge radiation damping, which was insignificant. Therefore, the device can drift in surge even if the system is subject to monochromatic forces. Generally, the drift is induced by the numerical algorithm and depends on what ramp function and numerical integration schemes are applied. OrcaFlex and WEC-Sim use different time integration schemes, have different methods for handling radiation terms in transition and probably use different matrix solvers. As a result, the device was predicted to drift 2 [m] in WEC-Sim and only 0.03 [m] in OrcaFlex when forced by T=8 [s] waves. Overall the WEC-Sim team is very pleased with the 3DOF code-to-code comparison results for the RM3 device.

PRELIMINARY WEC-SIM VALIDATION

Preliminary validation of WEC-Sim was also performed, by comparing the results of the WEC-Sim simulation of the RM3 two-body point absorber WEC to experimental wave tank data from a 1:33 Froude scale device. Further WEC-Sim validation is planned through a series of dedicated wave tank experiments after the code has its initial public release. The results given in the following sections are not from this dedicated WEC-Sim validation effort, and instead leverage existing data sets for preliminary WEC-Sim validation.

The simulations of the RM3 in WEC-Sim were performed at full scale for wave height, H = 3 m, and for wave periods ranging from 8 to 18 s, with a time-step of 0.01 s. For the WEC-Sim simulations, the PTO damping was assumed to be linear, and set to the average full-scale experimental damping value, 2,500 kN-s/m. Viscous drag plays a significant role in WEC motion, and tuning its numerical value is critical, especially for comparison to small-scale experimental data. In these simulations, the WEC-Sim code was run with the float drag coefficient set to 1.4, and the damping plate set to 4.3. Because the RM3's PTO is dependent on the relative motion between the float and the spar/plate, the relative heave motion response amplitude operators (RAOs) were used as a validation metric. The experimental RAOs are shown in Figure 12 as blue diamonds, and the WEC-Sim results are shown as a red dotted line. The WEC-Sim simulation accurately reproduces the RAO shape and magnitude, and does not systematically over- or under-predict device response. This serves as preliminary code validation by demonstrating WEC-Sim's ability to reproduce experimental results. Additional results from using WEC-Sim to model the RM3 can be found in OMAE2014-24312.

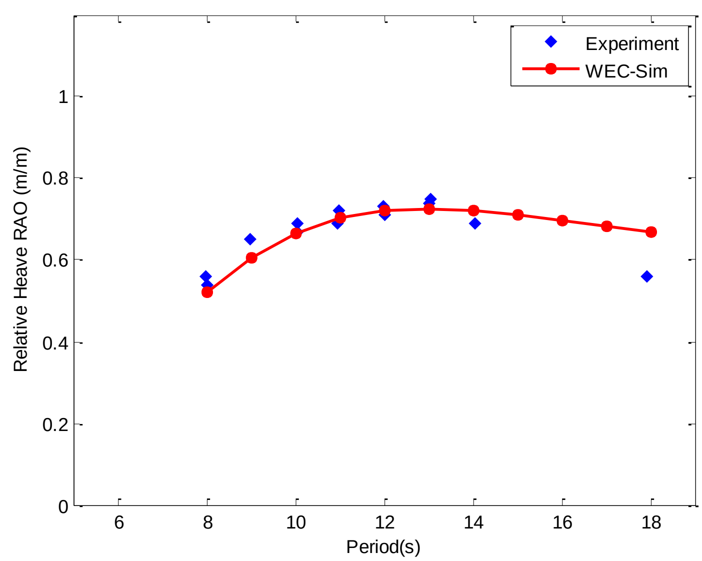


Figure 12. WEC-SIM Simulation Comparison to RM3 Experiments

OSWEC PITCHING DEVICE MODEL

The oscillating surge WEC (OSWEC) device, a two-body pitching Oyster-like design, was chosen as the second application of the WEC-Sim code. The OSWEC was chosen because its design is fundamentally different from the RM3. This is critical because WECs span an extensive design space, and it is important to model devices in WEC-Sim that operate under different principles. The RM3 is a semi-submerged device that is moored to the seafloor with a catenary mooring system, and is free to move in 6DOF, whereas the OWSEC is fixed to the ground and has a flap that is connected through a hinge to the base that restricts the flap to pitch around the hinge (1 DOF at the hinge).

This section presents a preliminary analysis on the application of WEC-Sim to model an OSWEC design. The study includes a verification analysis by comparing the WEC-Sim solutions to those obtained from the commercial code AQWA (ANSYS) and a validation study by comparing the WEC-Sim results to experimental measurements data. Additional results using WEC-Sim to model pitching WECs can be found in OMAE2014-24511.

GEOMETRY DEFINITION

The full-scale dimensions of the OSWEC and a snap shot of the WEC-Sim model setup are shown in Figure 14 and Figure 15. The mass properties are specified Table 4.

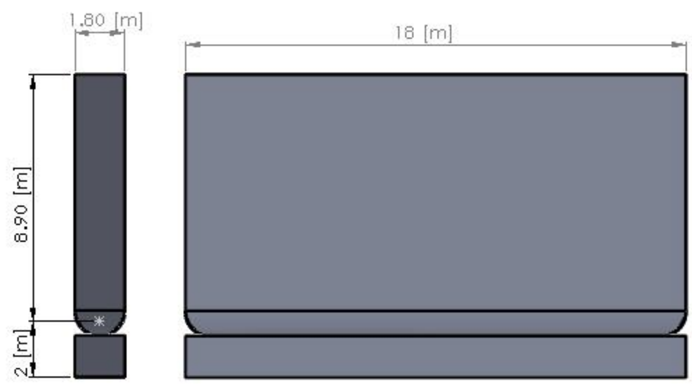


Figure 13. OSWEC Pitching Device Full-Scale Dimensions

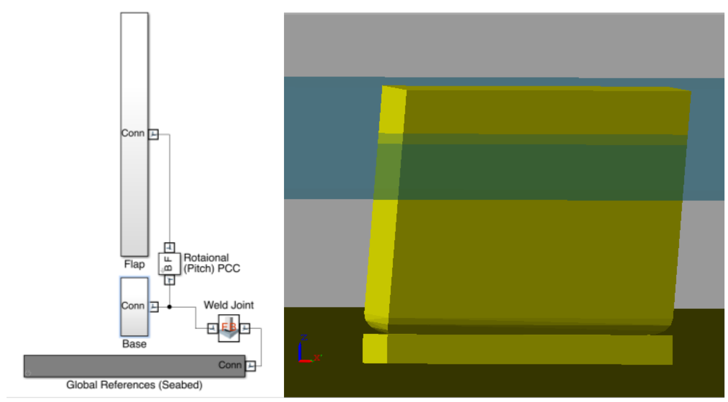


Figure 14. WEC-Sim Model setup for the bottom-hinged OSWEC

Table 4. OSWEC Pitching Device Full-Scale Mass Properties

Flap Full Scale Properties		
CG [m]	Mass [kg]	Pitch Moment of Inertia [kg-m^2]
0	127,000	1,850,000
0		
-3.9		

PRELIMINARY WEC-SIM VERIFICATION

In order to verify the functionality of the alpha version of WEC-Sim, a preliminary code-to-code comparison was performed. The OSWEC device described above was simulated in WEC-Sim, and the results were compared to those from a simulation of the same device using the commercial code AQWA (ANSYS). In the following subsections, results from the code-to-code comparison for both WEC-Sim and AQWA 1DOF (pitch) simulations are shown.

SIMULATION PARAMETERS

The simulation parameters were the same in both WEC-Sim and AQWA runs with a water depth of 10.9 [m] and a water density of 1000 [kg/m^3]. OSWEC simulations were run for representative regular operational waves of a constant wave height, H = 2.5 [m], and for wave period, T = 8 [s].

CODE-TO-CODE COMPARISON

The second verification effort for WEC-Sim was performed by modeling the OSWEC in using the alpha version of WEC-Sim, and comparing its results to those from AQWA. The codes were run for regular waves with T = 8 [s] and H = 2.5 [m], where the WEC motion was restricted to pitch around the hinge, and does not include any motion due to coupled DOFs. Simulations were performed with no PTO damping between the base and flat. Results from the regular wave simulation for the flap's pitch response are shown in Figure 15. The top plot shows the full 400 [s] time-series, and the bottom one shows the same figure zoomed in for the last two wave periods. While there is good phase agreement between the codes, it can be seen that there is a pretty large disagreement between the preliminary AQWA and WEC-Sim results. The WEC-Sim simulation of the OSWEC device shows symmetric response, whereas the AQWA simulation pitches more in one direction than the other. The magnitude of the response is also different, with AQWA simulating smaller pitch angles than WEC-Sim. The WEC-Sim team is currently troubleshooting these discrepancies and will report back with their findings.

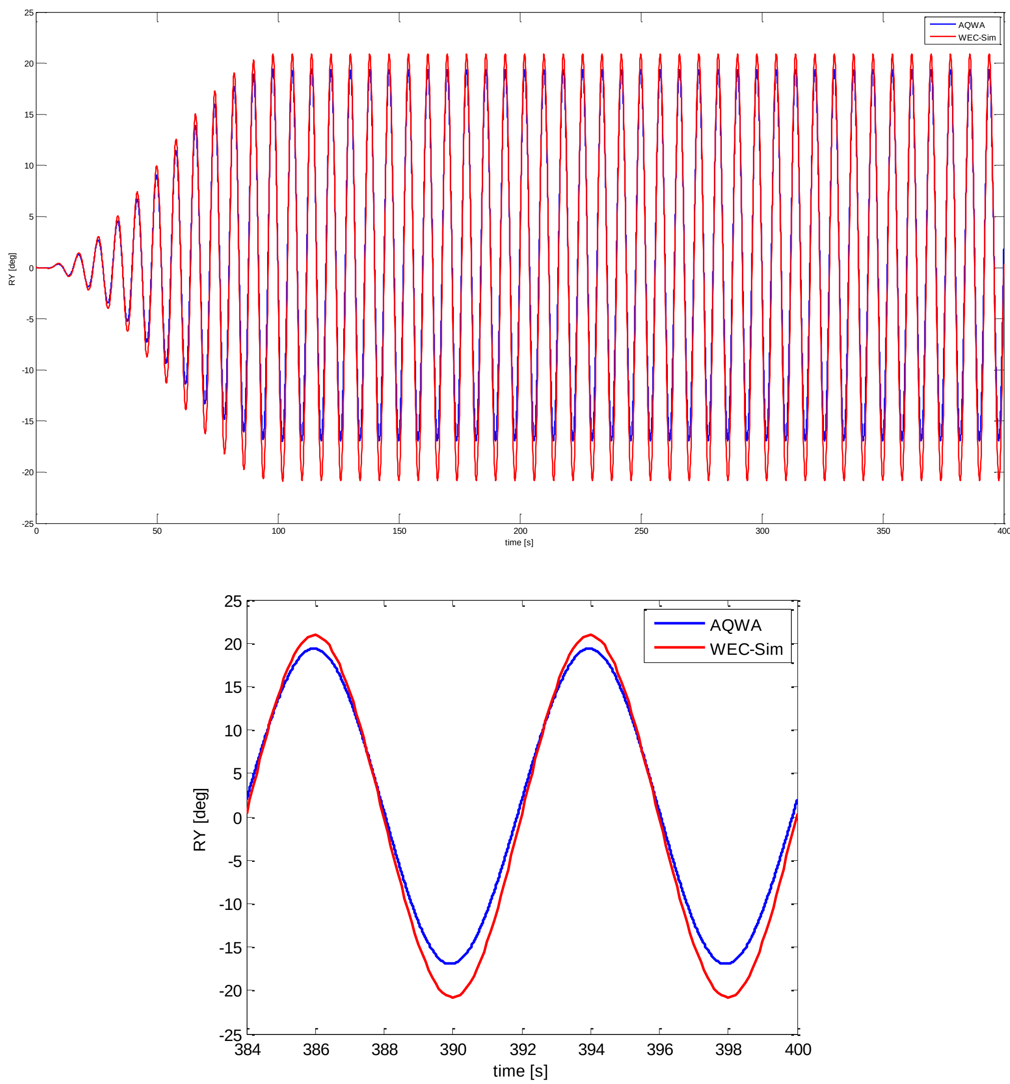


Figure 15. OSWEC pitch response with H=2.5 [m] and T = 8 [s] and 0 [kN-s/m] for the full time series (top) and zoomed in for the last few wave periods (bottom)

PRELIMINARY WEC-SIM VALIDATION

WEC-Sim was also applied to simulate the OSWEC in irregular sea states, and the results were compared to those obtained from the experimental measurements (van't Hof 2009). The mass properties were determined based on the values given by van't Hof 2009. Note that the mass properties were identical to those given in Table 4, except that the same value of the moment of inertia was defined at the hinge instead of the center of gravity.

WEC-Sim simulations were run at six selected sea states with different significant wave heights (H_s) and peak periods (T_p). The PTO damping coefficients were also selected based on the values given in the experimental study. For each case, the simulation duration was 125×T_p long with a ramp time of 25×T_p and a time step size of 0.01×T_p. A drag coefficient of 8 was selected for the flap motion (Babarit et al. 2011). Figure 16 shows an example of the flap response and power output from a WEC-Sim simulation with H_s=1.75 [m] and T_p=10.5 [s]. A preliminary validation of WEC-Sim was performed by comparing the averaged mechanical power results to those reported in van't Hoff's experimental study. The power production values are plotted against the energy period, T_e (T_e=1.16T_p), in Figure 17. Note that all the experimental values are presented in full scale. The WEC-Sim simulations results agreed well with those from the wave tank test measurements.

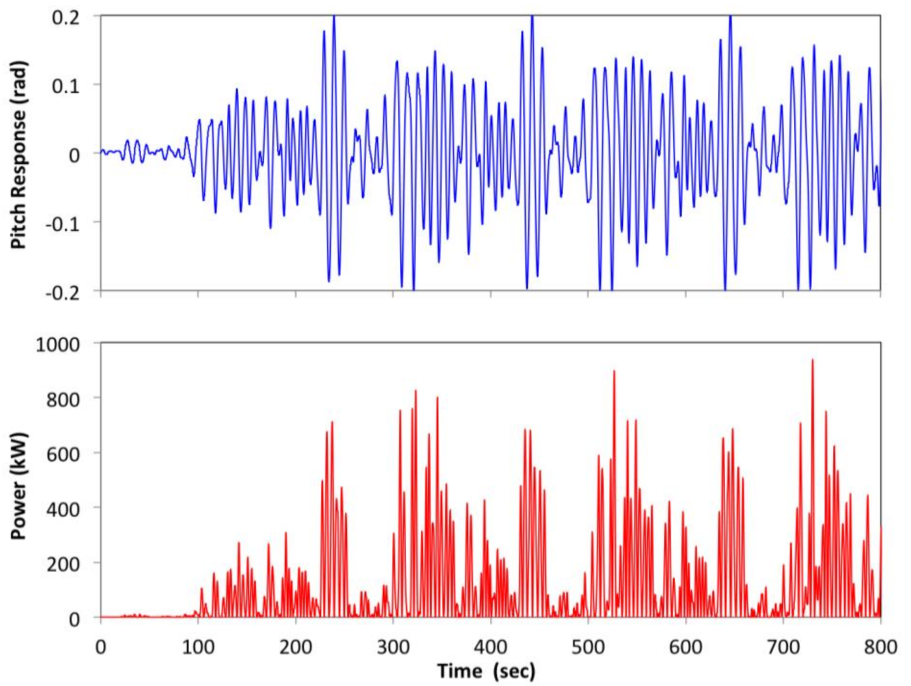


Figure 16. Example of instantaneous flap pitch response (top) and power output (bottom) from Wec-Sim (H_s=1.75 [m] and T_p=10.5 [s])

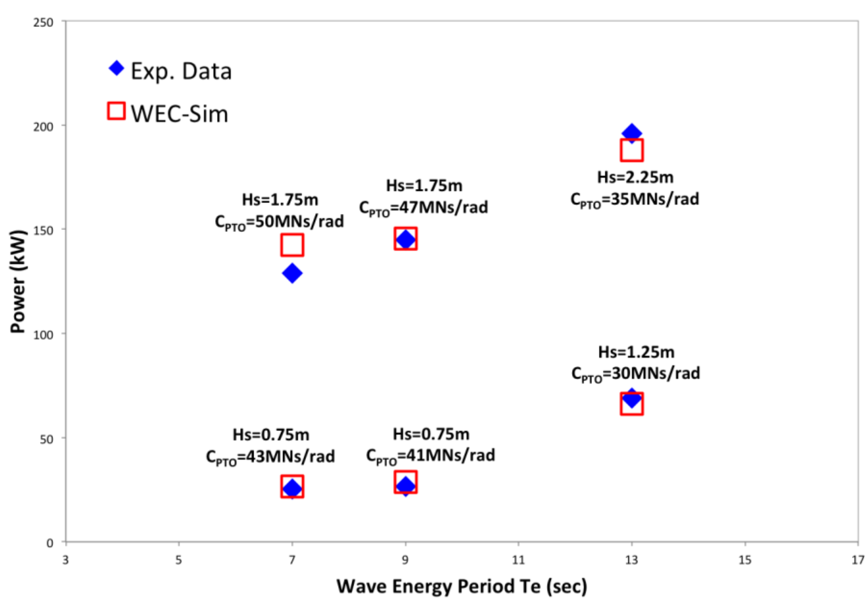


Figure 17 - Mechanical Power performance from WEC-Sim and experimental data

LIMITATIONS OF COMMERCIAL CODES

As discussed above, the WEC-Sim team has tested the commercial modeling codes WaveDyn, AQWA, and OrcaFlex. While all of these codes provide basic modeling capability needed to simulate WEC's, each code has limitations that preclude turn-key modeling of WEC devices. The remainder of this section reviews WaveDyn, AQWA, and OrcaFlex and discusses their limitations and nuances.

AQWA

AQWA was not originally developed to model WECs, its intended application was naval architecture and offshore oil and gas, thus AQWA has issues generating a sufficient mesh for complex geometries due to its limited number of diffracting and non-diffracting elements. Additionally, there are several flags specified in the AQWA input file that can keep the program from converging to a solution, and with AQWA's limited help files and user group, it can be difficult to determine the source of the error. An AQWA limitation, relevant for the RM3 design, is that it only allows for definition of rotational joints (hinge, ball and socket, universal and rigid), and does not allow definition of translational 'joints'. Thus applying PTO damping between two bodies with relative linear motion is not a functionality currently built into AQWA. Additionally, AQWA's time-domain codes, DRIFT and NAUT have slightly different default formulations and when setting up a model it is important to understand these nuances. For example, NAUT's default is non-linear, and determines wave forcing based on the instantaneous wetted surface area at each time step. This default must be overridden for direct comparison to WEC-Sim and WaveDyn which both use a linear formulation. Additionally, the AQWA user-interface is very clunky, crashes often, and much of the code's functionality isn't integrated into the GUI, meaning certain functionality is only available through modification of the text-based input files.

WAVEDYN

WaveDyn was developed specifically to model WEC devices and is therefore relatively straight forward to set up and run. The bottom line is that WaveDyn is developed for modeling WECs, but is still in the development process. The currently released version still uses the linear hydrodynamic restoring and excitation model and the robustness of the code, such as the time integration scheme and the use of ramp function, need to be improved so that the simulation will be more stable, particularly when rotational motion is considered.

Moreover, WaveDyn is at a very early stage of development. In fact, it appears that NREL is one of the first commercial users of the code and has found several bugs in the code (e.g. a broken mooring line module) and features that were not sufficiently documented. NREL has worked with the WaveDyn code developer (GL-GH) to address these issues and the result has been an improved WaveDyn code. Nevertheless, a significant amount of improvement to WaveDyn is needed before it is a turn-key commercial product. Specifically, non-linear buoyancy and excitation capabilities are needed, a viscous damping model must be developed, and better documentation and tutorials are needed. GL-GH is working hard to make these improvements and some of these issues will be addressed in the next release of WaveDyn, which is scheduled for early 2014.

ORCAFLEX

OrcaFlex is code developed for modeling the fluid/wave and structure interaction. It has widely been used for modeling the dynamics of offshore systems, such as offshore supply vessels and offshore platforms. OrcaFlex has a strong mooring capability and robust numerical integration algorithm. However, the code was not developed for modeling WECs, particularly multi-body designs. OrcaFlex only accepts single body WAMIT hydrodynamic coefficients for each body. As a result, users have to run a WAMIT run for each body, and the effect of the interaction between different bodies on the hydrodynamic coefficients is neglected. Technically, this can be avoided if users write their own functions to import correct hydrodynamic coefficients for each body from a single multiple-body WAMIT run or manually insert the correct values. However, this makes using OrcaFlex to model WECs more difficult.

CONCLUSIONS AND FUTURE WORK

The WEC-Sim project is currently on track. The SNL/NREL WEC-Sim team has met all of their FY14 milestones to date, as shown in the Gantt chart uploaded to the WEC-Sim SharePoint site in the *FY14 Q2 Deliverables* folder. Two fundamentally different WECs have been modeled in WEC-Sim; a two-body heaving point absorber (RM3), and a pitching device (OSWEC). The two WEC designs were used for code verification through code-to-code comparison with commercially available tools and preliminary code validation by comparing the WEC-Sim results to experimental data. Results from the preliminary verification and validation efforts are uploaded to the SharePoint site, and the WEC-Sim runs are uploaded to the GitHub site. The verification and validation results so far have been good and give us confidence in the code and its usefulness as an effective tool for the WEC community. Several conference papers, regarding the WEC-Sim code, have been submitted for publication and presentation (3 at OMAE 2014, and 1 at METS 2014). WEC-Sim presentations have sparked interest in the code, resulting in a pre-release to a limited user group. SNL and NREL are currently working together to meet the FY14 Q3 milestone of public release of the WEC-Sim code.