Hydrodynamic analysis of oscillating water column wave energy devices

A 40-chamber I-Beam attenuator-type, oscillating water column, wave energy converter is analyzed numerically based on linearized potential flow theory, and experimentally via model test experiments. The high-order panel method WAMIT by Newman and Lee (WAMIT: a radiation–diffraction panel program for wave-body interactions, 2014, http://www.wamit.com) is used for the basic wave-structure interaction analysis. The damping applied to each chamber by the power take off is modeled in the experiment by forcing the air through a hole with an area of about 1 % of the chamber water surface area. In the numerical model, this damping is modeled by an equivalent linearized damping coefficient which extracts the same amount of energy over one cycle as the experimentally measured quadratic damping coefficient. The pressure in each chamber in regular waves of three different height-to-length ratios is measured in the experiments and compared to calculations. The model is considered in both fixed and freely floating, slack-moored conditions. Comparisons are also made to experimental measurements on a single fixed chamber. The capture width ratio in each case is predicted based on the pressures in the chambers. Good agreement is found between the calculations and the experiments.