

Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Effect of the Sweep Angle on the Hydrodynamic Performance of a Fully-Passive Oscillating-Plate Hydrokinetic Turbine WALTFRID LEE, University of Victoria, GUY DUMAS, Laval University, PETER OSHKAI, University of Victoria — The influence of the sweep angle on the performance of a fully-passive oscillating-plate hydrokinetic turbine prototype was investigated experimentally. The sweep angle was introduced to promote spanwise flow along the plate in order to delay the shedding of the leading edge vortex (LEV). We considered two configurations: a plate with 6 degrees sweep angle and an un-swept plate (control), which were undergoing fully-passive pitch and heave motions in a uniform inflow at the Reynolds number of 19000. The resulting kinematic parameters and the energy extraction performance were evaluated for both plates. 2D particle image velocimetry (PIV) was used to obtain patterns of the phase-averaged out-of-plane vorticity during the oscillation cycle. The circulation in the wake was related to the loading on the plate by calculating the moments of vorticity with respect to the pitching axis of the plate. Tomographic (3D) PIV was implemented to evaluate the spanwise variation of the vortex structure. The results show evidence of the delay of the shedding of the LEV on the swept plate, which leads to the improvement of energy extraction performance of the fully-passive hydrokinetic turbine.

Waltfred Lee
Univ of Victoria

Date submitted: 07 Aug 2020

Electronic form version 1.4