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Experimental Investigation of Effects of Blockage and Free Surface Proximity on Flow-field and Performance of a Hydrokinetic Turbine[1]
NITIN KOLEKAR, ARINDAM BANERJEE, Lehigh University — Results from an experimental study to investigate the effect of blockage and free surface proximity on the performance of a constant chord, zero twist, fixed pitch hydro kinetic turbine in an open surface water channel will be presented. The presence of free surface and the size of turbine relative to the flow channel (blockage effect) affects the fluid dynamics around and in the near wake of turbine and hence the thrust-torque loading on turbine blades. Detailed parametric studies will be carried out to understand the effect of free surface proximity, Froude number (which depends on water velocity and depth of the channel), turbine proximity to channel walls and blockage on the turbine performance. Characterization of wake meandering and flow around the turbine is performed using a stereo-Particle Image Velocimetry technique for flows with various Froude number. The thrust and torque on turbine will be measured using a submerged thrust-torque sensor in-line with the turbine. The results of experiments will be compared with analytical models based on blade element momentum theory by modeling free surface and blockage effects.

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