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The dynamic interaction of a marine hydrokinetic turbine with its environment NITIN KOLEKAR, ARINDAM BANERJEE, Lehigh University — Unlike wind turbines, marine hydrokinetic and tidal turbines operate in a bounded flow environment where flow is constrained between deformable free surface and fixed river/sea bed. The proximity to free surface modifies the wake dynamics behind the turbine. Further, size & shape of this wake is not constant but depends on multiple factors like flow speed, turbine blade geometry, and rotational speed. In addition, the turbulence characteristics of incoming flow also affects the flow field and hence the performance. The current work aims at understanding the dynamic interaction of a hydrokinetic turbine (HkT) with free surface and flow turbulence through experimental investigations. Results will be presented from experimental study carried out in an open channel test facility at Lehigh University with a three bladed, constant chord, zero twist HkT under various operating conditions. Froude number (ratio of characteristic flow velocity to gravitational wave velocity) is used to characterize the effect of free surface proximity on turbine performance. Experimental results will be compared with analytical models based on blade element momentum theory. Characterization of wake meandering and flow around turbine will be performed using a stereo-Particle Image Velocimetry technique.

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