Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

A hybrid approach for power prediction of tidal stream turbine using transient blade element momentum theory[1] CONG HAN, ASHWIN VINOD, ARINDAM BANERJEE, Lehigh University, THOMAS LAKE, MICHAEL TOGNERI, IAN MASTERS, Swansea University — Blade Element Momentum (BEM) method is traditionally used to evaluate hydrodynamic performance of wind/tidal turbine blades. Steady-state BEM predictions are based on the assumption that the inflow is uniform at the rotor plane. Majority of tidal energy sites have high levels of Free-Stream Turbulence (FST) and power prediction in those scenarios needs to account for fluctuations in the free-stream. In addition, any variation in hydrofoil (lift-drag) dynamics due to FST needs to be also accounted for. A hybrid approach was implemented to predict the performance of a tidal turbine model in a water tunnel test section. Lift/drag characteristics of a SG6043 hydrofoil was measured in a water tunnel facility fitted with an active grid turbulence generator at Lehigh University. The inflow properties measured using an ADV along with lift/drag measurements are used an input to a transient BEM code. Validation and verification of this hybrid method is done by comparing the transient BEM predictions to the experimental torque-thrust measurements with a scaled turbine model under elevated FST conditions.

[1]The authors acknowledge financial support from NSF Fluid Dynamics (Grant 1706358)

Arindam Banerjee
Lehigh University

Date submitted: 01 Aug 2019 Electronic form version 1.4