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Numerical Simulations of Marine Hydrokinetic (MHK) Turbines Using the Blade Element Momentum Theory[1] TEYMOUR JAVAHERCHI, OSKAR THULIN, ALBERTO ALISEDA, University of Washington — Energy extraction from the available kinetic energy in tidal currents via Marine Hydrokinetic (MHK) turbines has recently attracted scientists' attention as a highly predictable source of renewable energy. The strongest tidal resources have a concentrated nature that require close turbine spacing in a farm of MHK turbines. This tight spacing, however, will lead to interaction of the downstream turbines with the turbulent wake generated by upstream turbines. This interaction can significantly reduce the power generated and possibly result in structural failure before the expected service life is completed. Development of a numerical methodology to study the turbine-wake interaction can provide a tool for optimization of turbine spacing to maximize the power generated in turbine arrays. In this work, we will present numerical simulations of the flow field in a farm of horizontal axis MHK turbines using the Blade Element Momentum Theory (BEMT). We compare the value of integral variables (i.e. efficiency, power, torque and etc.) calculated for each turbine in the farm for different arrangements with varying streamwise and lateral offsets between turbines. We find that BEMT provides accurate estimates of turbine efficiency under uniform flow conditions, but overpredicts the efficiency of downstream turbines when they are strongly affected by the wakes.

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