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Numerical simulation of a cross flow Marine Hydrokinetic turbine.[1] TAYLOR HALL, ALBERTO ALISEDA, Mechanical Engineering. University of Washington. — In the search for alternative sources of energy, the kinetic energy of water currents in oceans, rivers and estuaries is being explored as predictable and environmentally benign. We are investigating the flow past a cross flow turbine in which a helical blade under hydrodynamic forces turns around a shaft perpendicular to the free stream. This type of turbine, while very different from the classical horizontal axis turbine commonly used in the wind energy field, presents advantages for stacking in very narrow constricted channels where the water currents are consistently high and therefore turbine installation may be economically feasible. We use a model of a helical four-bladed turbine in cross flow to investigate the efficiency of the energy capture and the dynamics of the turbulent wake. Scale model experiments in a flume are used to validate the numerical results on a stationary configuration as an initial step towards creating an accurate numerical model of the turbine. The simulation of the rotating turbine provides a full perspective on the effect of angular position on flow detachment and vortex shedding from the blade, as well as on the fluctuations of the shaft torque produced (a problematic feature of this type of turbine). The results are analyzed in terms of hydrodynamic optimization of the blade and its structural loading.

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