“Development of a Tidal Current Turbine”

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ABSTRACT

Tidal Current energy can be eligible as one of the most interesting renewable and clean energy resources with the promise of a regular and predictable production of electricity. The “MWatForce” project from Guinard Energies proposed an original concept of a ducted tidal turbine driving a multi-stage pump which supplies hydraulic energy to coastal power stations equipped with Pelton turbines. Consequently, there is no underwater electrical device.

Design, numerical and experimental investigations of a tidal turbine have been performed by LMH EPFL in the framework of the “MWatForce” project. The design of the runner is based on Blade Element Momentum theory. Steady and unsteady numerical simulations of the full ducted tidal turbine in open flow conditions are performed with ANSYS CFX for different values of tip speed ratio. The tidal turbine performance are evaluated and optimized by taking into account cavitation development and structural limitations. The numerical results are then compared to experimental values obtained from model tests in a towing tank at the Bassin d’Essai des Carènes.

A power coefficient as much as 55\% is found for a tip speed ratio of 7. As expected, the pressure drop and the bulk velocity through the rotor as well are enhanced by the shaped duct compared to the free actuator disk, demonstrating the advantage of this design.

References