Project Summary

The project consists of a combination of computational modelling as well as laboratory studies of a novel concept for a vertical axis tidal turbine; particularly near field studies of the turbine i.e. its performance characteristics and thus optimising the design.

Current Work

Laboratory Studies

A prototype is being tested and analysed in the Hydraulics Laboratory using the NERC Flume. Analysis includes:

- Data capturing for inlet boundary condition: Using an ADV to measure the 3D water velocity. A sampling rate of 200Hz per data point enabled turbulence to be calculated.
- Characterisation of the turbines performance through power coefficient \( (C_p) \) and TSR (Tip Speed Ratio) charts.
- “Kit Style” manufacturing of prototype; enabling optimisation of turbine configuration without need to construct a complete new prototype.
- Collected data will enable validation of CFD models.

Computational Modelling-CFD analysis

- Used as an optimisation tool in order to enhance performance as well as allowing the analysis of the fluid behaviour in the near field of the turbine.
- Currently using models with simplified geometries to compare torque values with experimental values.
- Modelling static state cases in order to determine the static torque at numerous points within a revolution.

Future Work

- Improving experimental set up through connecting an encoder to the shaft, enabling the relationship between torque fluctuations and position of turbine to be established.
- Optimising the design through:
  - Changing the prototypes configuration; Based upon increasing its efficiency as well as minimising any torque fluctuations.
  - Post configuration optimisation-further optimisation achieved through minimising any losses within the testing apparatus such as bearing losses and possible weight reductions etc
- Construction of a gear system in order to connect the turbine to a PMG (Permanent Magnet Generator).
  - Enabling comparison with performance data achieved via the load cell thus validating the load cell experimental set up.
- Possibly identifying materials that can be used in marine environments and the corrosion resistant techniques available.

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