Capability Statement
Computational Fluid Dynamics for Tidal Turbines

Introduction

MMI Engineering has specialist knowledge in the application of CFD for external and internal flows. The CFD team is highly experienced in the use of generalised CFD codes, such as CFX and Fluent, to solve steady state and transient problems associated with fluid-structure interaction, such as the analysis of pumps and turbines.

CFD can be used as a virtual water tunnel for testing the performance of turbines in terms of power extraction and to visualise features of the flow. Figure 2 shows iso-surfaces of vorticity, the curl of the velocity vector around a tidal turbine.

The pressure and shear forces on the blades of a turbine allow the power and hence the efficiency to be computed [2]. This makes CFD an ideal tool for optimisation.

The features of the flow around and forces acting on supporting structures, such as stanchions and spars, are of importance. Figure 3 shows a structure for supporting a 5 tidal turbine array and the velocity field around this is shown below.

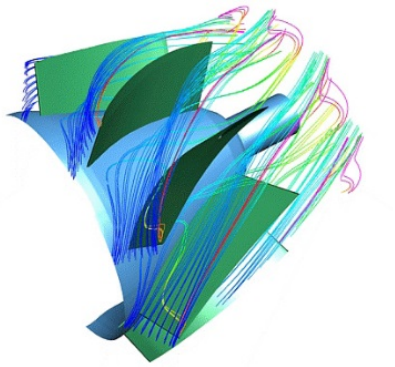

Figure 1: Stream lines around the diffuser blades for an axial pump [1]

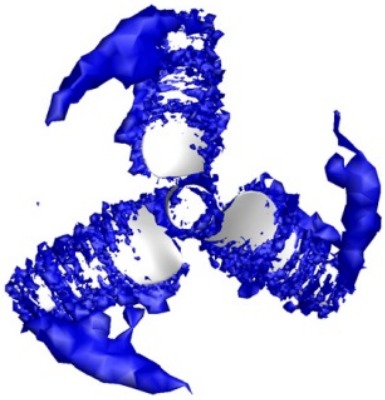

Figure 2: Iso-surfaces of vorticity; the curl of the velocity

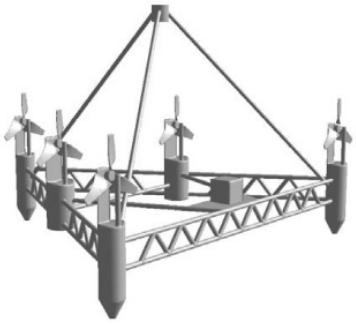

Figure 3: Supporting structure for a 5 turbine array [3]vector

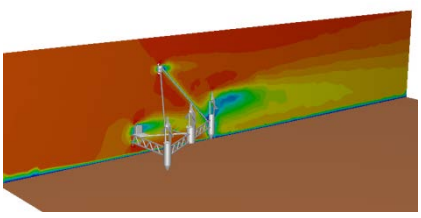

Figure 4: Velocity field around a 5 turbine array with the flow

Value Added

CFD provides the capability to assess the adequacy of designs prior to construction. It is an excellent optimising tool and can help give a thorough understanding of flow mechanisms for mechanical design and safety assessments.

Publications

[1] Burt, D.J., Purdom, T. and Spence, R., 1998, Prediction of the Three Dimensional Flow Field in a Vertical Mixed Flow Pump with Vaned Diffuser, IMecheE Seminar Pub, October 15th, pp. 59-69.

[2] Egarr, D.A., O'Doherty, T., Morris, S., Ayre, R.G., 2004, Feasibility study using computational fluid dynamics for the use of a turbine for extracting energy from the tide, Proceedings of the Fifteenth Australasian Fluid Mechanics Conference, 13-17th December, CD-ROM, ISBN 1 864 87695 6.

[3] Egarr, D.A., O'Doherty, T., Morris, S., Syred, N., Ayre, R.G., 2005, Computational study of tidal turbines for extracting energy from the tides, International Symposium on EcoTopia Science, Nagoya, Japan, 8-9th August, pp.73-76.

© MMI Engineering, 2014

www.mmiengineering.com
info@mmiengineering.com