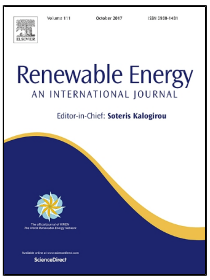
Accepted Manuscript



Probabilistic prediction of cavitation on rotor blades of tidal stream turbines

Leon Chernin, Dimitri V. Val

PII:	S0960-1481(17)30542-6
DOI:	10.1016/j.renene.2017.06.037
Reference:	RENE 8902
To appear in:	*Renewable Energy*
Received Date:	21 April 2016
Revised Date:	19 May 2017
Accepted Date:	07 June 2017

Please cite this article as: Leon Chernin, Dimitri V. Val, Probabilistic prediction of cavitation on rotor blades of tidal stream turbines, *Renewable Energy* (2017), doi: 10.1016/j.renene.2017.06.037

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Probabilistic prediction of cavitation on rotor blades of tidal stream turbines

Leon Chernin[a] and Dimitri V. Val[b,*]

[a] *School of Engineering, Physics and Mathematics, University of Dundee, Dundee DD1 4HN, United Kingdom*

[b] *Institute for Infrastructure & Environment, Heriot-Watt University, Edinburgh EH14 4AS, United Kingdom*

Abstract

Power generation from tidal currents is currently a fast developing sector of the renewable energy industry. A number of technologies are under development within this sector, of which the most popular one is based on the use of horizontal axis turbines with propeller-type blades. When such a turbine is operating, the interaction of its rotating blades with seawater induces pressure fluctuations on the blade surface which may cause cavitation. Depending on its extent and severity, cavitation may damage the blades through erosion of their surface, while underwater noise caused by cavitation may be harmful to marine life. Hence, it is important to prevent cavitation or at least limit its harmful effects. The paper presents a method for predicting the probability of cavitation on blades of a horizontal axis tidal stream turbine. Uncertainties associated with the velocities of seawater and water depth above the turbine blades are taken into account. It is shown how using the probabilistic analysis the expected time of exposure of the blade surfaces to cavitation can be estimated.

Keywords: Tidal stream turbine, rotor blades, cavitation, turbulence, waves, probability

Highlights:

- A probabilistic approach to predicting the cavitation on the rotor blades of a tidal stream turbine is proposed
- Probabilistic models describing uncertainties associated with the velocities of seawater and water depth above the turbine blades are introduced
- A case study illustrating the application of the new probabilistic approach as well as an existing deterministic approach is presented
- It is shown that the existing deterministic approach does not provide sufficient data for rational and economically efficient design of tidal stream turbines for cavitation

* Corresponding author: Tel.: +44 1314514622; fax: +44 1314514617.
E-mail address: d.val@hw.ac.uk

Download English Version:

https://daneshyari.com/en/article/4926063

Download Persian Version:

https://daneshyari.com/article/4926063

Daneshyari.com