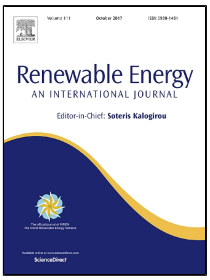
Accepted Manuscript



Performance prediction of a prototype tidal power turbine by using a suitable numerical model

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PII:	S0960-1481(17)30522-0
DOI:	10.1016/j.renene.2017.06.021
Reference:	RENE 8885
To appear in:	*Renewable Energy*
Received Date:	17 May 2016
Revised Date:	17 May 2017
Accepted Date:	03 June 2017

Please cite this article as: Soo-Hwang Ahn, Yexiang Xiao, Zhengwei Wang, Xuezhi Zhou, Yongyao Luo, Performance prediction of a prototype tidal power turbine by using a suitable numerical model, *Renewable Energy* (2017), doi: 10.1016/j.renene.2017.06.021

Performance prediction of a prototype tidal power turbine by using a suitable numerical model

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Abstract. For tidal power stations, turbines operate in a wide head range and sometimes near the free surface due to tide changes, which commonly consists of short intake channel. When they operate under low water levels, free surface flows would be a major concern for hydraulic stability. The present paper establishes a simulation method for predicting all flow fields in tidal power stations. Two-phase simulation model is introduced with the acceleration of gravity and the free surface, which consists of a turbine unit and two reservoir models (sea side and reservoir side). Hydraulic performance of a prototype turbine was predicted by using the proposed model, based on water levels of both two sides. The predicted unit performance agreed well with the test result. The flow fields were compared with ones by two other simulation methods. The proposed method could predict non-uniform intake flow inducing head losses by the sudden contraction and the gravity force, which sufficiently influenced turbine internal flows. Consequently, head drops in each part of the turbine were distributed differently, under the same net head. The present model provides a foundation for predicting prototype turbine performances under not only tide changes but also air-water interactions.

Keywords: prototype performance, tidal power turbine, two-phase flow field, reservoir model, gravity force effect

1. Introduction

Ocean energy represents a high energy density source among renewable energy sources, which has the great potential environmentally friendly [1]. Tidal energy is by tidal movements derived from the force of

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