Performance Of Three-Bladed Archimedes Screw Turbine Using Response Surface Methodology

Publisher: IEEE

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Abstract:
Experimental study of Archimedes screw turbine had been done in laboratory scale. Performance of Archimedes screw turbine was influenced by geometric and fluid characteristic that flow in screw turbine. The aim of this research is to compare the performace of Archimedes screw turbine with using response surface methodology. The screw turbine model was made of acrylic. Performance testing of screw turbines is carried out with independent variables of flow rate, depth of turbine inlet flow and turbine shaft slope. While the dependent variable is the power and efficiency of the turbine.The results of this study are the screw turbines obtained maximum power and efficiency of 10.28 watts and 82.72% respectively with a shaft slope of 51.82 degrees, depth of turbine inlet flow of 0.064 m, and speed of inlet flow of 0.6 m/s.

Published in: 2018 International Conference on Applied Science and Technology (iCAST)

Date of Conference: 26-27 October 2018

INSPEC Accession Number: 18796646

Date Added to IEEE *Xplore*: 01 July 2019

DOI: 10.1109/ICAST1.2018.8751600

▸ ISBN Information:

Publisher: IEEE

Conference Location: Manado, Indonesia

Contents

I. Introduction

The study of Archimedes screw turbine is being developed including the numerical optimization of screw thread geometry (Rorres 2000) that the optimum range ratio depends on the number of blades and the radius ratio (R_1/R_0) equal to 0.54. Then (Müeller Gerald 2009) simplified Archimedes's screw theory based on geometric parameters and the ideal energy conversion process for one helical turn. The results of this research stated that the efficiency of screw turbines was influenced by geometry and flow losses. Furthermore (Nuembergk Dirk M., Rorres 2013) introduced the analytical model of screw turbine inflow by calculating the possibility of leakage flow in the gap between the thread and the outer cylinder (casing) and also the excess water in the center of the pipe. MATLAB simulation of screw turbines for hydropower plants at low head has been carried out (Ali Raza et al. 2013). Model and the Reading (Müeller Gerald 2009), (Nuembergk Dirk M., Rorres 2013), and (Ali Raza et al. 2013) they compare this with experiments from Brada (1996a) and Brada (1996b). Subsequent research was conducted by Havendry Adly and Hendro Lius (2010) regarding the determination of the optimum screw angle in screw turbines with 23°, 26° and 29° screw angle variations. In his report explained that the 29° screw angle produces better power and efficiency compared to 23° and 26° screw angles. Then Hizhar Yul (2011) examined the effect of the difference in pitch and the slope of the axis on the performance of the two-blade screw turbine model at low head flow. The result of the research was that the 2Ro range results in a rotating speed higher than 1.6Ro and 1.2Ro. And the greatest power wasvproduced at a slope angle of 35° from the slope of the other turbine shaft 25°, 30°, 40°.

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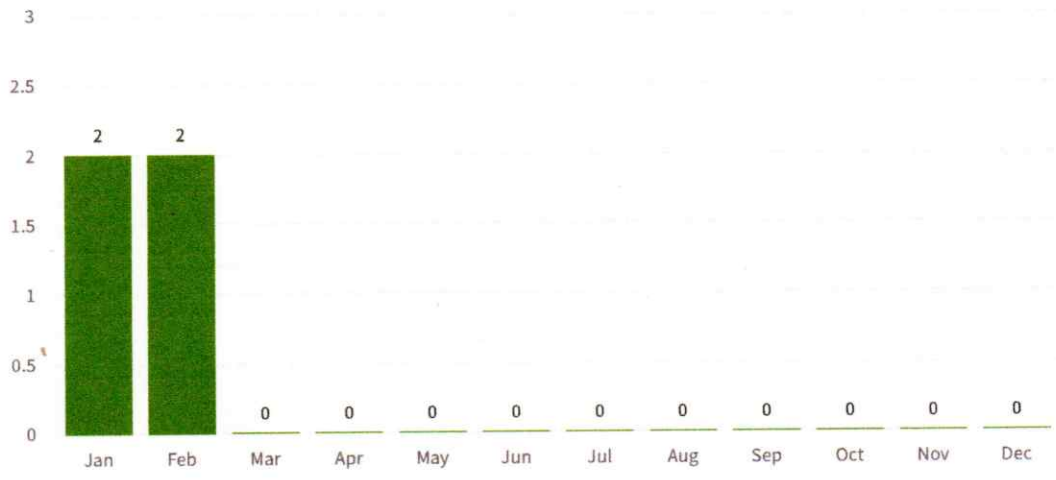

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