International Journal of Mechanical Engineering and Applications
2020; 8(6): 145-153
http://www.sciencepublishinggroup.com/j/ijmea
doi: 10.11648/j.ijmea.20200806.14
ISSN: 2330-023X (Print); ISSN: 2330-0248 (Online)

Some Aspects Regarding Torque Study and Elaboration of the Blades Orientation Mechanism for Microhydropower Plant

Bostan Viorel, Bostan Ion, Dulgheru Valeriu*, Ciobanu Oleg

Department of Fundamental Mashine Design, Technical University of Moldova, Chishinau, Republic of Moldova

Email address:

viorel.bostan@adm.utm.md (B. Viorel), ion.bostan@cnts.utm.md (B. Ion), valeriu.dulgheru@bpm.utm.md (D. Valeriu), oleg.ciobanu@bpm.utm.md (C. Oleg)

*Corresponding author

To cite this article:

Bostan Viorel, Bostan Ion, Dulgheru Valeriu, Ciobanu Oleg. Some Aspects Regarding Torque Study and Elaboration of the Blades Orientation Mechanism for Microhydropower Plant. *International Journal of Mechanical Engineering and Applications.* Vol. 8, No. 6, 2020, pp. 145-153. doi: 10.11648/j.ijmea.20200806.14

Received: November 3, 2020; **Accepted**: November 16, 2020; **Published**: December 8, 2020

Abstract: The analysis of hydraulic energy conversion systems has demonstrated the opportunity for the development of water kinetic energy conversion systems compared to potential energy conversion systems. Insistent searches of authors have led to the design and licensing of some advanced technical solutions for outflow micro hydroelectric power plants. They are based on the hydrodynamic effect, generated by the hydrodynamic profile of blades and by the optimal blades' orientation towards water streams with account of energy conversion at each rotation phase of the turbine rotor. The basic advantage of the flow microhydropower plant is the increase of the conversion efficiency by the simultaneous use of the pressure effects of water streams on the blade surface and of the hydrodynamic effect generated by the hydrodynamic profile of the blade with continuous blade orientation. The most important nodes of the microhydropower plant are the hydrodynamic rotor with vertical axis and the mechanism of continuous orientation of the blades depending on the direction of water currents. The paper makes an analysis of the brief torque and of the forces applied on the hydrodynamic blades located in the transition zone from the upstream area to the downstream area, by positioning the blades according to the flow velocity of the water flow which leads to increased hydrodynamics forces developed by each blade and the simultaneous reduction of the hydraulic resistance forces to the rotation of the blades, based on which the mechanism of orienting the blades in optimal positions against water currents was designed, developed, and manufactured.

Keywords: Micro Hydropower, Rotor, Hydrodynamic Profile, Hydrodynamic Coefficients, Torque

1. Introduction

The use of Renewable Energy Sources (RES) is a global priority, conditioned and argued by energy security, climate change and environmental protection and not at all for industrial and economic development.

Hydraulic energy is one of the most used RES, being one of the cheapest, quality and clean energy sources. As a renewable energy source, hydraulic energy can be obtained in two forms:

Potential energy (free fall of water);

Kinetic energy (flow of water currents).

The study of recent years shows that, due to low costs, large-scale hydropower is not a successful option for the future of energy production in developed countries, for various reasons, such as the environment, for example. The construction of dams on rivers has created major social and environmental problems. The artificial formation of huge water reservoirs by blocking the main arteries of the Earth has led to climate change and wildlife in the region, to the creation of sources of greenhouse gases.

A more efficient use of hydraulic energy, from the point of view of ecological and social impact, is the conversion of kinetic energy of flowing water of rivers, without the construction of dams by using flow microhydropower plants (floating), which are more cost effective, because they do not include essential costs related to civil constructions, wins in the competition on energy supply especially of isolated