Determination of Theoritical Shaft Torque on Turbin Gorlov Model with Wavy Blade

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ABSTRAK

This paper discuss about the computational study of determination shaft torque of vertical axis water turbine (VAWT) which construct using Gorlov concept. In this research, the study conducted by modification of blade profile using wavy dispositive in order to increase the drag and lift coefficient. Simulation is conducted using Numeca software in 2-D, which is intended to get the lift and drag coefficient relationship in various angle of attack. Value of real angle of attack at various positions of turbine blades can be determined by a triangle speed rules and can be simulated by using Matlab software.

Special algorithm is developed based on mathematical formulation and simulate using Matlab programing. Mathematical formulation is developed using multi cross section element (slice) of VAWT blade, which then twist integrated along blade span. Twist developed based on angular position of blade cross section related to the first. Lift and drag parameter which is the main variable of calculation, also developed from 0 to 360 degree angular position. Based on computation study result, so theoretical torque value of VAWT obtained, for one cross section as well as full turbine. Vortex generator as a special dispositive which using in VAWT will augmented the theoretical of shaft torque.

Kata kunci : VAWT, Theoretical Torsion, Twist Integration

DETERMINATION OF THEORETICAL SHAFT TORQUE ON TURBIN GORLOV MODEL WITH WAVY BLADE

Experimentell VAWT installation

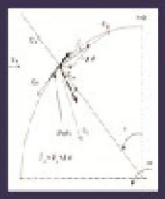
Electricity energy is obtained

Experimental study in the river water current

Optimize

$$F_t = q\,S\,[C_t \sin(\gamma - \alpha) + C_q \cos(\gamma - \alpha)]$$

$$T = r\,F_t = r\,q\,S\,[C_t \sin(\gamma - \alpha) + C_q \cos(\gamma - \alpha)]$$

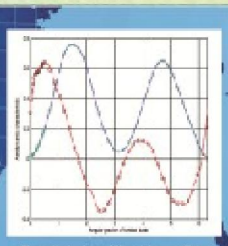


Forces on the blade

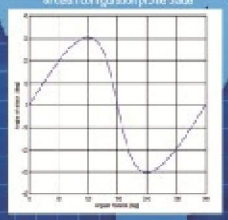
Component of force on the blade

Production result of test set-up

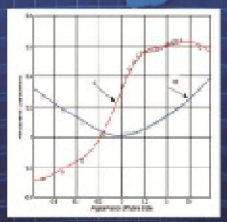
TASV rotation speed measurement process



Theoretical values of lift and drag coefficient of clean configuration profile blade



Theoretical values of lift and drag coefficient of wavy configuration profile blade at the domain



Theoretical value of angle of attack of turbine blade, 45 rpm and 4.2 m/s

CONCLUSION

Simple computational programming has been developed to help accelerate the determination of the theoretical torque value. The application can be justified design that the theoretical torque acting on the turbine will increase significantly, as occurs in an airfoil with wavy. Supposition.

Special treatment on airfoil blade VAWT using dispositive to change the flow pattern around it has increased the theoretical torque. Results are still a computation study which require study on the wind tunnel and field in order to validate the result.

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