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# A NUMERICAL ANALYSIS OF THE UNSTEADY FLOW ROUND A SAVONIUS TURBINE

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This paper presents a numerical analysis of the unsteady flow round the two blades Savonius rotor. The main goal of this research is to investigate the influence of transient effects on performace of the turbine. Because of the intensity of flow through the gap, that depends on vortices, the performance of whole rotor itself also depends on flow structure between blades.

The main parameter describing the Sovonius Rotor is torque coefficient. The fallowing equation presents the physical dependency

$$C_T = \frac{T}{\frac{1}{4}\rho U^2 D^2 H}, \tag{1}$$

where T stands for the torque, $\rho$ represents density, $U$ - far field velocity, $D$ - diameter of the rotor and finally $H$ is height of the rotor. Figure 1 shows comparison between present calculations and other data available in literature. It has to be pointed out that most of the available data is obtained from steady state calculations whereas present calculations are fully transient.

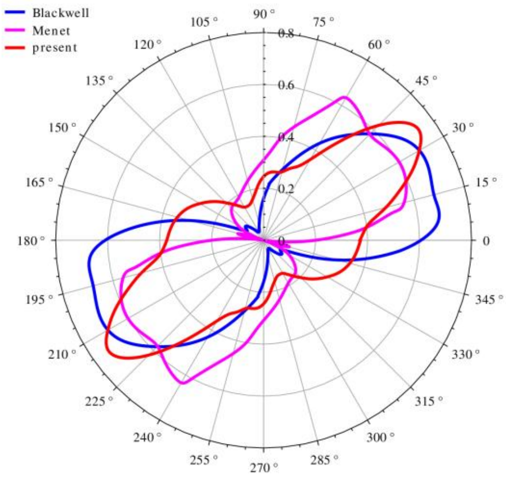


Figure 1: Torque coefficient distribution

The transient efficiency is defined here as

$$\eta = \frac{\omega \int_t^{t+\Delta t} T(t)dt}{\rho \frac{U^3}{2} HD\Delta t}, \tag{2}$$

where $\omega$ represents angular velocity and $\Delta t$ stands for the time of interest (e.g. half a round). The above definition is directly related to the torque coefficient (1). The higher the torque coefficient the more efficient the rotor. This is because the wind energy is kept constant.

The numerical investigation are based on requirements of practical experiment, what explain the geometry, shapes and physical ratios of Savonius Rotor. The main boundary and physical conditions taken under consideration for CFD analysis are: type of flow, wind velocity, rotational speed.

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