A moment coefficient computational study of parametric drag-driven wind turbine at moderate tip speed ratios

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ABSTRACT

This paper presents the CFD numerical investigation of novel drag-driven wind turbine blade inspired by spiral optimisation algorithm (SPO) and cycloid curve. In this study, six hybrid spiral geometries were analysed via CFD simulation using FLUENT based on URANS and SST numerical model. The simulated results of six shapes were compared against simulated conventional Savonius wind turbine. In terms of moment coefficient, all the turbines were simulated under similar computational configuration. The turbines were studied at two moderate tip speed ratios, which are $\lambda = 0.59$ and $\lambda = 0.94$, under constant freestream velocity of 8 *m/s*. The result shows that design shape S-4 displayed higher moment coefficient than Savonius wind turbine with an improvement of 7.2% in moment coefficient at $\lambda = 0.59$. However, at $\lambda = 0.94$, the percentage of improvement in moment coefficient is only 4%. It is observed that reduction in blade height and modification of blade curve configuration improve the moment of the rotor. The sharp edge presented by the hybrid spiral shape induces higher pressure gradient than Savonius wind turbine on the convex side of the blade.

KEYWORDS

Savonius wind turbine; CFD; Wind energy; Sliding mesh

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