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Enhancing Aerodynamic Performance of Savonius Vertical Axis Turbine Used with Triboelectric Generator

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Abstract : This project aims to design a system to generate energy from flowing wind due to the motion of a vehicle on the road or from the flow of wind in compact areas to utilize the wasteful energy into a useful one. It is envisaged through a design and aerodynamic performance improvement of a Savonius vertical axis wind turbine rotor and used in an integrated system with a Triboelectric Nanogenerator (TENG) that can generate a good amount of electrical energy. Aerodynamic calculations are performed numerically using Computational Fluid Dynamics software, and TENG's performance is evaluated analytically. The Turbine's coefficient of power is validated with published results for an inlet velocity of 7 m/s with a Tip Speed Ratio of 0.75 and found to reasonably agree with that of experiment results. The baseline design is modified with a new blade arc angle and rotor position angle based on the recommended parameter ranges suggested by previous researchers. Simulations have been performed for different T.S.R. values ranging from 0.25 to 1.5 with an interval of 0.25 with two applicable free stream velocities of 5 m/s and 7m/s. Finally, the newly designed VAWT CFD performance results are used as input for the analytical performance prediction of the triboelectric nanogenerator. The results show that this approach could be feasible and useful for small power source applications.

Keywords : savonius turbine, power, overlap ratio, tip speed ratio, TENG
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