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Experimental and Computational Fluid Dynamics Analysis of Horizontal Axis Wind Turbine

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Abstract : Wind power has now become one of the most important resources of renewable energy. The machine which extracts kinetic energy from wind is wind turbine. This work is all about the electrical power analysis of horizontal axis wind turbine to check the efficiency of different configurations of wind turbines to get maximum output and comparison of experimental and Computational Fluid Dynamics (CFD) results. Different experiments have been performed to obtain that configuration with the help of which we can get the maximum electrical power output by changing the different parameters like the number of blades, blade shape, wind speed, etc. in first step experimentation is done, and then the similar configuration is designed in 3D CAD software. After a series of experiments, it has been found that the turbine with four blades at an angle of 75° gives maximum power output and increase in wind speed increases the power output. The models designed on CAD software are imported on ANSYS-FLUENT to predict mechanical power. This mechanical power is then converted into electrical power, and the results were approximately the same in both cases. In the end, a comparison has been done to compare the results of experiments and ANSYS-FLUENT.

Keywords : computational analysis, power efficiency, wind energy, wind turbine
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