Application of a Hybrid Modified Blade Element Momentum Theory/Computational Fluid Dynamics Approach for Wine Turbine Aerodynamic Performances Prediction

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Abstract : In the field of wind turbine blades, it is complicated to evaluate the aerodynamic performances through experimental measurements as it requires a lot of computing time and resources. Therefore, in this paper, a hybrid BEM-CFD numerical technique is developed to predict power and aerodynamic forces acting on the blades. Computational fluid dynamics (CFD) simulation was conducted to calculate the drag and lift forces through Ansys software using the K-w model. Then an enhanced BEM code was created to predict the power outputs generated by the wind turbine using the aerodynamic properties extracted from the CFD approach. The numerical approach was compared and validated with experimental data. The power curves calculated from this hybrid method were in good agreement with experimental measurements for all velocity ranges.

Keywords : blade element momentum, aerodynamic forces, wind turbine blades, computational fluid dynamics approach
Conference Title : ICIEEA 2024 : International Conference on Informatics, Environment, Energy and Applications
Conference Location : Paris, France
Conference Dates : February 19-20, 2024