

Numerical Investigation of the Diffuser: Geometrical Parameters Effect on Flow Characteristics for Diffuser Augmented Wind Turbine

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Abstract : This study deals with numerical simulation using a commercial package 'ANSYS FLUENT 14.5' for flow characteristics of a flanged diffuser wind turbine. Influence of geometrical parameters such as flange height, diffuser length, and expansion angle on the lift and drag performance were investigated. As the angle of expansion increases, a considerable flow acceleration through the diffuser occur at expansion angle ranged from 0° and 12° due to the presence of undisturbed streamlines. after that flow circulation is developed near the diffuser outlet and increase with increasing expansion angle which causes a negligible effect of expansion angle. The effect of diffuser length on flow behavior shows that when the diffuser length ratio is less than 1.25, flow acceleration is observed and increased with diffuser length ratio. After this value, the flow field at diffuser outlet is characterized by a recirculation zone. The diffuser flange has an impact effect of the flow behavior as a low pressure zone is developed behind the flange, while a high pressure zone is generated in front of it. As the flange height increase, the intensity of both low and high pressure regions increase which tend to accelerate the flow inside the diffuser till flange height ratio reaches to 0.75.

Keywords : wind turbine, flanged diffuser, expansion angle, diffuser length

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