

Optimum Geometrical Shape Parameters for Conical Diffusers in Ducted Wind Turbines

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Abstract

Encasing of wind turbines in ducts to increase wind energy extraction has been under study for several decades. Ducts are meant to accelerate the wind speed past the wind turbine rotor enclosed in the duct. The most common duct used in wind turbines is a diffuser. Wind speed augmentation in diffusers depends on the geometrical shape parameters of the diffuser, mainly the diffuser expansion angle and the non-dimensional length. This paper addresses wind speed augmentation by empty conical diffusers. It presents the dependence of the wind speed augmentation on the diffuser geometrical shape parameters and the optimum geometrical shape parameters for maximum wind speed augmentation. It is shown that for a given θ , wind speed augmentation increases with L up to the maximum wind speed augmentation and starts to decrease. Each θ has a unique L which gives the maximum wind speed augmentation. It has also been shown that the maximum wind speed augmentation increases with V . For V wind speed increased from 1.48 m/s to 1.55 m/s.