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Panel method for the wake effects on the aerodynamics of vertical-axis wind turbines UDIT GOYAL, Graduate Student, DIETMAR REMPFER, Associate Professor — A formulation based on the panel method is implemented for studying the unsteady aerodynamics of straight-bladed vertical-axis wind turbines. A combination of source and vortex distributions is used to represent an airfoil in Darrieus type motion. Our approach represents a low-cost computational technique that takes into account the dynamic changes in angle of attack of the blade during a cycle. A time-stepping mechanism is introduced for the wake convection, and its effects on the aerodynamic forces on the blade are discussed. The focus of the study is to describe the effect of the trailing wakes on the upstream flow conditions and coefficient of performance of the turbines. Results show a decrease in Cp until the wake structure develops and assumes a quasi-steady behavior. A comparison with other models such as single and multiple streamtubes is discussed, and optimization of the blade pitch angle is performed to increase the instantaneous torque and hence the power output from the turbine.

Udit Goyal
Graduate Student

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