

Centralized Wind Power Plant Voltage Control with Optimal Power Flow Algorithm

Jared Kline

Abstract

This thesis presents a method of controlling the reactive power injected into a medium-voltage collection system by multiple wind turbine generators such that the voltage at one bus is maintained at a specified level. The proposed control accounts for the system impedance between the wind turbine generator terminals and the point of interconnect, and utilizes an optimal power flow algorithm to dispatch reactive power amongst the wind turbine generators. This optimal power flow algorithm minimizes real power losses within the wind power plant and avoids operating conditions that violate various operating constraints.

This thesis presents a 100 wind turbine generator wind plant test system and uses this test system to demonstrate the potential increased revenues occasioned by the proposed control system as compared to a system that dispatches the wind turbine generator reactive power injections uniformly. Analysis shows that it can be cost effective to install the proposed control system.