Wind Turbines: Novel Control Algorithm in Region II

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ABSTRACT
In this paper it is seen that the performance of adaptive disturbance tracking control with measured wind speed is comparable to that of existing baseline fixed gain controller. The major drawback of baseline fixed controller is its dependence on many variables to calculate the optimum gain (K) for KΩ^2 law. On the other hand the adaptive disturbance tracking control does not require knowledge of extensive sets of variables but it requires wind speed measurement. There are many devices which can be used to measure the wind speed, two such primary devices being light detection and ranging and anemometer. Light detection and ranging can measure the wind speed accurately but is very expensive which increases the overall costs of wind turbine installation. An anemometer is a cheap alternative but it does not give the accurate wind speed measurement which can be used in control loop. As an alternative, a simple wind speed estimator is proposed which uses the generator speed as input and estimates wind speed from it. Moreover, this estimator does not require wind turbine parameters to estimate the wind speed. This allows flexibility in modeling errors and hence such kinds of errors have negligible impact in the control design. The theory of linear control systems is well matured, and linear control systems usually do not need to have a stability proof. In the case of non-linear and adaptive control theory, the controller design must be backed-up with theoretical analysis to ensure the stability of the controller. The main goals of this paper are to: 1. Design adaptive controllers in the second operating regions of wind turbine. 2. Evaluate the performance of the controllers using simulation. 3. Analyze the controllers for stability and convergence.

KEYWORDS: Wind turbine control, advanced control strategy, Adaptive disturbance tracking control

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