Design of a Robust Speed and Position Sensorless Decoupled P-Q Controlled Doubly-Fed Induction Generator for Variable-Speed Wind Energy Applications

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Abstract

This paper proposes an implementation of a decoupled P-Q control of a DFIG that does not rely on mechanical sensors and a speed and position sensorless algorithm that is robust to variations of the values of the machine parameters. In this paper, the sensorless control is based on a modified phase-locked loop with an improved positioning algorithm. This eliminates the need to estimate the speed based on the machine parameters, which results in a significant improvement in speed control robustness to parameter variations. In addition, the algorithm avoids using differentiation which can lead to significant inaccuracy due to the noise inherent in measured signals. Theoretical and simulation results were validated on an experimental setup, using a laboratory 5 hp DFIG.

Keywords: angular velocity control; asynchronous generators; machine control; phase locked loops; position control; robust control; wind power plants