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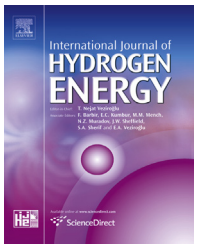

Short Communication

Particle swarm optimization based sliding mode control of variable speed wind energy conversion system

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ABSTRACT

This paper proposes a particle swarm optimization based sliding mode control of squirrel cage induction generator of a variable speed wind energy conversion system. The key feature of sliding mode control is a wisely chosen sliding surface which allows the turbine to operate more or less close to the optimal regimes characteristic. Optimal control parameters which are the convergence speed to the sliding-mode, the slope of the surface and the switching component amplitude of SMC are determined using particle swarm optimization approach. The simulation results prove the viability of the proposed control structure.

Introduction

Wind energy conversion systems, being an environmentally friendly and economically competitive means of producing electricity; have experienced a tremendous growth in the past decade [1]. Generally, a constant speed wind turbine coupled with a squirrel cage induction generator designed to extract maximum power at a specified speed is used for the wind power generation. However, as the wind speed varies, it becomes necessary to vary the turbine speed accordingly in such a way that the optimum tip speed ratio is maintained at its optimum value despite wind variations [2]. This requirement can be facilitated by means of power electronic circuits along with appropriate control strategies. The common approach is the utilization of aerodynamic control systems involving the pitch angle control of the turbine blades. However, this method makes the system expensive and complex, particularly for systems with large wind turbines. This paper proposes a sliding mode controller for variable speed wind turbine systems using cage induction generator (SCIG).

The sliding-mode control (SMC) approach is one of effective tools to design robust controllers for nonlinear systems

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