

# Design and real time implementation of sliding mode supervised fractional controller for wind energy conversion system under sever working conditions

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**Abstract:** Wind energy conversion system (WECS) is increasingly taking the place to be the most promised renewable source of energy, which obliges researchers to look for effective control with low cost. Thus, this paper proposes to build a suitable controller for speed control loop to reach the maximum power point of the wind turbine under severe conditions and to ensure the stability of the outer voltage regulation loop to meet high range of load variations. In literature, a major defect of the well-used conventional PI controller is the slow response time and the high damping. Nowadays, intelligent controllers have been used to solve the drawbacks of the conventional ones but they demand high speed calculators and expensive cost. Moreover, many solutions proposed the fractional order PI controller (FO-PI) by extending the order of integration from integer to real order. The FO-PI controller presents also some weakness in steady state caused by the approximation methods. The idea of this paper is to propose a Sliding Mode Supervised Fractional order controller (SMSF) which consists of conventional PI controller, FO-PI controller and sliding mode supervisor (SMS) that employs one of the controllers to ensure good steady and transient states. WECS laboratory prototype is built around real-time dSPACE cards and evaluated to verify the validity of the developed SMSF. The results clearly fulfill the requirements, confirm its high performance in steady and transient states and demonstrate its feasibility and effectiveness.

**Keywords :** Maximum Power Point Tracking (MPPT), Wind Energy Conversion System (WECS), PI controller, Fractional order PI controller, Sliding mode control, Direct power control