# Quantifying the Impact of Sensor Precision on Power Output of A Wind Turbine: A Sensitivity Analysis and Monte Carlo Simulation Study

Moein Sarbandi[1] and Hamid Khaloozadeh[1*]

[1]Department of Systems and Control Engineering, K. N. Toosi University of Technology, Tehran, Iran.

*Corresponding author. E-mail: h_khaloozadeh@kntu.ac.ir;
Contributing author: sarbandi_moein@email.kntu.ac.ir;

**Abstract**

Wind turbines (WTs) are complex systems with multiple interacting components that pose challenges in identifying and comprehending factors affecting power output (PO). Sensors play a crucial role in monitoring turbine performance, but sensor precision can result in measured values differing from true values. Thus, analyzing the impact of sensor precision on PO is essential. In this study, we employ sensitivity analysis (SA) and Monte Carlo (MC) simulation to quantify the impact of sensor precision on the PO of a 4.8 MW WT. We focus on evaluations under 5 to 20 m/s wind profiles, representing partial and full load regions that portray normal operation. Our results, based on mean squared error (MSE) and parameter sensitivity (PS) index analyses, reveal the generator speed sensor's precision has the most significant impact on PO. This suggests designers should prioritize this sensor when allocating resources.

**Keywords:** Wind turbine, Sensor precision, Sensitivity Analysis, Monte Carlo simulation, Parameter sensitivity index