

Microgrid Islanding Detection Using D-PMU and Phase Angle Analysis of Negative Sequence Impedance

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Unintentional islanding detection is a major challenge during the operation of a microgrid. When islanding occurs, distributed energy resources (DERs) need to be disconnected quickly, under 2 seconds, which makes fast islanding detection crucial. This paper describes a novel method for microgrid islanding detection utilizing distribution phasor measurement unit (D-PMU). The method involves examining the changes in the negative sequence impedance angle over time. Unlike past literature that uses only the phase angles of voltage and current sequence components for islanding detection, this method is more effective, as the phase angle of impedance captures the overall effects of resistance and reactance, which offers a clearer understanding of electrical behavior during disturbances. The study models a six-bus microgrid test case and a three-phase distribution phasor measurement unit (D-PMU) in PSCAD/EMTDC. Different non-islanding and islanding cases are analyzed through simulation, and the proposed method's performance is evaluated in both the six-bus microgrid model and the standard IEEE-34 node system. The technique's online performance is assessed using the industry-standard PhasorSmart software. The suggested detection technique can effectively distinguish non-islanding events while achieving islanding detection in under 50 ms, significantly faster than current passive techniques.