

## Abstract

Voltage conditions and power quality for customers and utility equipment are significantly impacted by the addition of microgrid-generating sources within distribution networks. Designing the right control for distributed generators for the various generating units of a Microgrid is important in enabling the synchronization of renewable energy generation sources, energy storage unity, and integration of Microgrids into a radial distribution network. This research provides control mechanisms based on an adaptive technique employing ANFIS, to reduce fluctuation of voltage and current difficulties faced when multiple renewable energy sources and storage systems are incorporated into a distribution network. A step-by-step Voltage Source Converter (VSC) Controller was designed for controlling the DC voltage power sources used. The ANFIS training, test system modeling, and the distributed energy source were modeled in MATLAB/SIMULINK 2021a Software. Four microgrids were developed each consisting of a Photovoltaic plant, Wind Turbine, and Battery Storage System. Non-critical and critical loads were considered during the system testing. The simulated result reveals that the proposed control system works effectively in maintaining a constant system voltage of 340VAC which significantly mitigates system voltage and current fluctuation without using any static synchronous compensator (STATCOM) and power system stabilizers.