Abstract

The bulk integration of renewable energy sources into the power grid brings about fresh challenges in grid protection, notably in the modification of fault levels. Also, the intermittent nature of renewable energy source inputs makes it challenging for traditional protection methods like overcurrent and distance relays to reliably safeguard these systems. This study introduces an Independent Component Analysis-Support Vector Machine-based protection system tailored to tackle the protection issues arising from renewable energy integration. This method was developed and tested on a 50kV 180km transmission line that was highly penetrated with solar photovoltaics, simulated in MATLAB/Simulink. Simulations were conducted for different fault types, signal noise levels, and fault resistances. The simulation results were then compared with the results of other methods published in available literature. The accuracy of the Independent Component Analysis-Support Vector Machine algorithm in determining the location of faults for the different scenarios was above 99.7%. The fault classification accuracy ranged between 99% and 100% for different levels of signal to noise ratio. Although the method is not as accurate when applied to power systems with high penetration of renewable energy sources as opposed to when applied to conventional power systems, the simulation results are satisfactory since they are higher than 99% which is the accuracy threshold for fault location and classification.