ABSTRACT

The penetration of Renewable Energy Sources (RESs) into microgrids is gaining huge significance in recent times. RESs are integrated with conventional grid systems to meet the growing energy demand and to enhance the power quality. The increasing penetration of RES into the grid system affects the stability of frequency in microgrids due to the stochastic nature of photovoltaic (PV) and wind energy generation. Unlike in traditional power generation systems, the lack of rotational inertia in microgrids is one of the critical concerns which affects the integration of RES with the grid system through power electronic converters. This introduces more uncertainties into the system and hence the operation and control of such a system becomes more complicated. In order to maintain the stability of microgrids and to effectively utilize RESs and distributed generation (DG) systems, it is essential to control virtual inertia. Proper inertia control improves the flexibility of microgrid operation and as a result various controlling strategies have been proposed in the past to control the virtual inertia. This work presents a new virtual inertia control (VIC) approach with a multi power level controller (MPLC) for RES integrated microgrids. Considering the high-level penetration of RES, the proposed approach is designed to enhance the system performance under sudden load variations and frequency variations. The efficiency of the proposed control approach is validated with and without MPLC. Results show that the controller achieves better frequency stability with MPLC. Advanced control algorithms can be used to create virtual inertia, which can mimic the stabilizing effect of traditional rotating mass in conventional power systems. An interconnected power framework's complete framework inertia might be impressively decreased because of a sharp ascent in utilization of renewable energy sources (RESs) based on force converter, making a framework more vulnerable to framework instability. This work recommends another use of virtual inertia control to further develop recurrence dependability of the connected power framework because of high entrance level of RESs. We present the subsidiary control approach, expected for more significant level virtual inertia imitating applications. The suggested virtual inertia control circle has a second-request hallmark that further enhances recurring dependability and strength. Δf values differ between 17.4215 and 20.3621 with significant frequency variations due to conventional control. Equally, virtual inertia control exhibits a high level of efficiency in reducing frequency deviations; The Δf values were consistently smaller between 0.0236 and 0.0369 than the conventional control.