4.0 Conclusion and Recommendation

Quality of power supply and usage is highly dependent on frequency and voltage consistency. Voltage and frequency, on the other hand, vary from their nominal values from time to time owing to major and minor disruptions caused by abrupt load fluctuations, transmission system failures, equipment loss and malfunction, and soon. They impair the system's functioning and may lead to blackouts. An uncertain power system, which is continuously susceptible to step and random disturbances, lends itself well to the ADRC's resilience against disturbance. There are just two tuning parameters for the ADRC, and both of them are easy to determine. Voltage regulation (via SVC) and LFC are two important power system control loops that have been successfully used using the traditional ADRC. SVC and LFC have each been studied separately in literature, but they have never been studied together. In effect, the traditional ADRC pushes the ACE to zero. A review of the integration of DERs for frequency control in future power networks was given in the study. A study was conducted on the integration of demand-side frequency regulation and BESS as DERs. The literature-based models used to model the ERWHs and HPWHs aggregates were used. For example, residential-based BESS were aggregated with a large-scale BESS, and electric vehicles (EVs) were aggregated with either smart charging stations at home or at stations. In order to show the efficacy of the new techniques in regulating frequency, the Nigerian power system and the 14-machine Nigerian power system were used. We modeled many different scenarios for the availability of DERs and used real-world disruptions as inputs. Incorporating several DERs resulted in a significant improvement in frequency responsiveness. the Nigerian power system with 14.5 gigawatts of system demand was disrupted and water heater and BESS-based distributed energy resources were combined to minimize frequency deviation and error.

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