Chapter 9

Conclusion

In this thesis, a PV-Wind hybrid power system was considered to implement a Tie-line frequency bias control of interconnected two-area hybrid power system. In order to develop a control technique, the mathematical modeling of the hybrid power system is essential. The mathematical modeling of PV based generation is studied with selecting the accurate model of PV cell by performing a comparative analysis of different equation based and model based implementation of PV cell. Further MPPT based boost converter with P & O algorithm to track MPP is investigated. The DC output voltage from PV system is brought to the desired level of 220 V and maintained constant irrespective of change in environmental and load variations.

After establishing the PV based generation mathematical modeling of wind-based generation is studied. The performance of the HAWT coupled to PMSG based wind power generation is analyzed under varying load and wind speed conditions. The performance of the HCS MPPT algorithm to track the maximum power point under varying wind speed and load is simulated. From the simulations results, it can be comprehended that during load change the output voltage is not smooth. In order to overcome this effect and to have better output voltage a FLC-based MPPT controller implementation for the system is investigated.

Further, the performance of the MPPT tracking algorithm implementation using Simulink block and proposed FLC are investigated. The FLC-based MPPT controller exhibits enhanced control as compared with the other MPPT technique. Further, the real-time data of solar illumination and wind speed measured at BITS-Pilani, Hyderabad Campus are analyzed. Utilizing this real time data the performance of the FLC-based MPPT control is evaluated under constant and variable load condition. It is observed that the controller performance is as desired.

The historical data of wind speed and solar illumination recorded at the location is utilized to for long term and short term prediction of the same. Different prediction techniques are analyzed and an accurate model is selected to predict i.e. NN model for forecasting long term and a day ahead prediction for both Solar and the Wind. Further, this model is utilized for forecasting power generated by hybrid power system in long term or short term utilizing the prediction method.

IN the proposed PV Wind hybrid system when in the standalone mode the AC load frequency control is controlled by two novel techniques:

1. Discrete PLL,

2. Droop Characteristics based control.

These control techniques are investigated for a different pattern of load changes in the system with real time data of solar illumination and wind speed. From the study, it is comprehended that the Droop characteristics based LFC control exhibit enhanced control over Discrete PLL based LFC.

The performance of the proposed PV-Wind hybrid power is analyzed under grid-connected mode. The investigation of the system is carried out under varying solar illumination and wind speed and it is observed that the maximum power extracted from the environmental conditions is injected into the grid. Further investigating into the implementation of Tie-line frequency control of interconnected two-area PV-wind hybrid power system with proposed droop characteristics based control. The system is investigated for change in load in one area and the performance of the Tie-line control technique is evaluated. The mathematical and simulated results of the study exhibit satisfactory operation of the controller by

maintaining the system voltage, frequency and tie-line power interchange in the specified limits.

Future work / Improvements

1. Reactive power compensation in hybrid power system,
2. A DC microgrid can be utilized for HVDC transmission,
3. Testing different MPPT algorithm techniques,
4. Application of optimization techniques for the LFC of PV-Wind hybrid power system