ABSTRACT

Electricity is one of the basic needs for a common man regardless of his geological area. Its demand is expanding manifold because of the quick populace development and more noteworthy utilization of power for better way of life. As the regular wellsprings of energy are contracting, a need has emerged to search for elective wellsprings of energy with more accentuation on its ideal utilize. One of the real issues that mankind needs to confront in the following 50 years is energy emergency. The rising populace, quickly changing ways of life of individuals, substantial industrialization and changing scene of urban areas, have expanded the energy demands, colossally.

Wind Energy Conversion Systems(WECS) have been drawing in wide consideration as a sustainable power source because of exhausting petroleum derivative stores and ecological worries as an immediate outcome of utilizing non-renewable energy source and atomic energy sources. Wind energy despite the fact that plentiful, fluctuates consistently as wind speed changes for the duration of the day. The irregular sustainable power sources may be coordinated with dispersion organize over different multi-string topologies.

In Variable Speed WECS (VSWECS), the Permanent Magnet Synchronous Generator (PMSG) has acquired expanded consideration in view of its advantages such as power factor, good proficiency and expanded unwavering quality because of its self-excitation property. A power modeling arrangement of a VSWECS framework, particularly in little limit PMSG wind framework, comprises of a rectifier, a DC-DC support converter and a matrix associated converter.

The framework associated converters are coordinated with the dispersion system to manage the power stream or streamline the power factor by controlling the dynamic and responsive power trade to matrix by utilizing the control strategies.

This work gives a detailed discussion on the operation of multilevel inverters for PMSG using Wind Power Generation System connected to grid by means of power electronic interface. This system incorporates low to medium wind speed operation. It consists of two Pulse Width Modulation(PWM) converters with a common dc-link. Maximum power point tracking is achieved by the generator-side converter control. The grid-side converter is controlled to provide the generated power and to supply the harmonics demanded by the local load at Point of Common Coupling (PCC). It causes the grid to supply only the sinusoidal current at unity power factor. The voltage management and interactions of active and reactive powers are done by Proportional Integral(PI) controller. The method of hysteresis current control is adopted for the controllability of quick current. The obtained result is analyzed by comparing the PWM inverter output with multilevel inverter. A working model of variable speed WECS with directly driven PMSG-based is developed and is simulated using MATLAB in order to authenticate the control strategy adopted.

This work proposes enhanced Perturb and Observe (P&O) method that utilizes the DC current as the fluctuating variable. The method detects quick wind speed shifts indirectly over the dc-link voltage slope. The voltage slope is also used to upgrade the tracking speed of the method and to avert the generator from stalling under accelerated wind speed falloff circumstances. The proposed approach uses two modes of operation: A P&O mode with adaptive step size under slow wind speed inconstancy conditions, and a prediction mode occupied under rapid wind speed transform

circumstances. The dc-link capacitor voltage slope reflects the expedition information of the generator, which is then used to prognosticate the next step size and change of inductor current. The proposed method shows increased stability and diligent tracking skill under both high and low rate of varying wind speed circumstances.

Fuzzy Logic Controller(FLC) is developed to tune the parameters of PI controller for a maximum power tracking strategy of variable speed wind turbine. The system consists of direct drive PMSG, diode rectifier which is used to convert the ac output voltage from the wind generation unit into DC voltage, a DC-DC switch-mode step up boost converter which is used to catch the maximum power from the wind, and a power control system. The output of the controller is given to the DC-DC converter to adjust the duty cycle in turn the rotor speed of PMSG is controlled to get the maximum power. The proposed control algorithm allows the generator to track the optimal operation points of the wind turbine system under fluctuating wind conditions. The proposed algorithm does not require the knowledge of intangible turbine mechanical characteristics such as its power coefficient curve, power characteristic or torque characteristic instead the algorithm uses rotor speed measurement as control variable inputs. MATLAB simulation study results confirm that the proposed controller algorithm is effective in tracking maximum power with good dynamic and steady state performance. The power fluctuations are stabilized resulting in constant output power and higher order harmonics are filtered. The WECS can be applied for powering domestic loads and grid connected applications.