ABSTRACT

The goal of this thesis is to enhance voltage stability of the Wind Power Generation System. Even though the rotor speed varies within the specified range, the terminal voltage should be maintained stable. The load voltage should be maintained stable although the load will be varied.

Decay of terminal voltage as a response to load variations of generation has been termed as terminal voltage instability and causes instability in receiving end voltage also. The terminal voltage stability of the Self-Excited Induction Generator is enhanced using stator flux oriented vector control method. An approach to maintain the terminal voltage stability by varying the flux using the d-q axis model is proposed based on stator flux oriented vector control method.

To enhance the load voltage stability, the STATCOM is proposed as the active VAR supporter. Even though, the primary purpose of the STATCOM is to support the load voltage by injecting or absorbing reactive power, it is also capable of improving the voltage stability.

The steady state performance of STATCOM based on six pulse voltage source converter by which the stator flux oriented vector control of terminal voltage for Self-Excited Induction Generator is also proposed. In this approach the total flux is aligned to the d-axis of the stator flux in the excitation reference frame. A decoupling signal is also generated to cancel the effect of q-axis current on the d-axis flux or total flux. The load voltage of the Self-Excited Induction Generator is controlled by d-q equivalent model using STATCOM controller.
An approach to maintain the load voltage stability, Sliding Mode Control is proposed to switch the DC-DC converter. Sliding Mode Control has been proposed to enhance the robustness and the dynamic response of the load voltage. This control technique provides stability, robustness, good dynamic response and simple implementation for large load variations.

$H_{\infty}$ controller is proposed to design a robust control for a Buck-Boost converter to enhance the load voltage stability. The $H_{\infty}$ controller is used in Self-Excited Induction Generator to achieve robust voltage performance or stabilization. A new control scheme is proposed using the combined Sliding Mode Control and $H_{\infty}$ that involves both controllers in the control loop. The proposed techniques of $H_{\infty}$ and Sliding Mode Control are applied to design a robust controller for a buck-boost converter. In general, the performance of the $H_{\infty}$ controller is superior to that of the Sliding Mode Control. The proposed combined controller provides superior performance in load voltage stability.

Hence, it is proposed in the thesis about the enhancement of the terminal and load voltage stability using various modern schemes. The proposed methods are fast and accurate such that control signals can be sent to appropriate locations quickly and effectively.