CHAPTER 6

Conclusion and Further Research

6.1 Conclusion

In this thesis, the direct power control techniques for the DFIG driven by the small hydro turbine have been presented. The proposed DFIG system uses the back-to-back three-level NPC VSC, which improves the waveform of voltage outputs, reduces the harmonic content compared to the conventional converter, increases the power rating and decreases the stress across the switches when compared the two-level converter. Both control strategies for the rotor-side and the grid-side converter have been proposed. The rotor-side converter control is based on the stator voltage vector control technique, which can be independently controlled the stator active and reactive power with the torque and the field in the generator. The control scheme for the grid-side converter uses the standard utility grid voltage vector control, which controls the dc-link voltage and the reactive power to the utility grid from the converter. The performance simulations show that this strategy is able to yield a good dynamic responses and high accuracy to the active and reactive power control.

Furthermore, a novel CB-PWM strategy for the three-level NPC VSC has been proposed. It is shown that only one the triangular carrier wave is employed to generate the gating pulses in the proposed converter. This significantly simplifies the modulation strategy. Experimental results confirms the good performance of the output voltages and the almost sinusoidal output phase currents in the dynamic and steady-state operations under high and low modulation indices. The main advantages associated are simple PWM algorithm, reduce capacitor voltage ripple, lower switching frequencies, and easy hardware implementation.

6.2 Further research

The further works are suggested as follows:

1) This thesis shows the simulation results of the overall DFIG system, which requires the experimental.
2) Apply the rotor speed-sensorless position algorithm for the proposed rotor-side converter control can be further improved.
3) To analyze the DFIG system dynamic response. This system response under the proposed direct power control and CB-PWM schemes can be analyzed. The design procedure of the control schemes can be further developed.
4) Development of the modulation technique which can balance dc-link voltage of the back-to-back three-level NPC VSC for the DFIG system.