ABSTRACT

With the increased popularity and wide spread use of the grid connected Double Output Induction Generator in the Variable Speed Constant Frequency wind electric power generation system for more than two decades, the researchers have turned attention towards analyzing the DOIG based wind power generation system in the stand alone mode in the recent years. Distributed generation system or otherwise islanding of a grid connected wind power generator due to system fault necessitates operating such system in the isolated mode. To the best of the knowledge of the author no work has been reported yet dealing with the optimal operation (in the sense of minimum machine loss) of the stand alone DOIG based wind power generation system.

This thesis reports the analysis and control algorithm formulation for a DOIG based stand alone VSCF generation system, operating over a wide range of the rotational speed and loading conditions. A systematic analysis and design of various controllers are carried out in this work. Also a simulation model for studying the performance of the stand alone system in steady state as well as in transient conditions is developed in the MATLAB SIMULINK platform. The effect of machine parameter variation on the controller performance is also investigated analytically in this work.

Next, an optimal operation procedure is presented to make the stand alone DOIG operate along the minimum machine loss trajectory while observing the machine and converter current limits and the wind turbine speed limit. The reactive power supplied through the two converters is dynamically distributed between them for any loading condition and wind velocity so as to minimize the machine power loss. The theoretically developed “Minimum machine loss” algorithm is verified by simulation and experiment on a laboratory prototype to establish the effectiveness of the proposed procedure.

Key-words: *DOIG, optimal operation, stand alone VSCF generation, reactive power, wind turbine, minimum machine power loss*