Modeling and Simulation of Multi-Level Power Converters for Wind Turbine Systems using Matlab-Simulink

Group: 7

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Abstract: In India, the renewable energy capacity has doubled in the past eight years. As of January 2023, it has the fourth-largest installed wind power capacity globally, clocking in at just under 42 Gigawatts (GW). This shows the potential and the need for renewable resources and the scope of execution. Diversifying energy supply towards sources like wind, hydropower, solar energy, etc., is necessary to decrease dependence on fossil fuels. Wind farms are growing worldwide, and with the emergence of modern grid systems, wind energy systems are making a significant impact in penetrating the current energy market. Even though challenges persist, wind energy is a versatile source with a direct connection with power transmission with high scalability. In order to synchronize a wind turbine with the grid, a power electronic converter is used. This allows us to efficiently convert a variable frequency output of an induction generator, driven by a variable speed wind turbine, to one with a fixed frequency suitable for the grid.

In this research, we will simulate various types of power converter models, including but not limited to a three-level neutral point clamped converter for wind turbines (3L-NPC/ANPC) and a modular multilevel converter. Various parameters, such as the turbine's frequency and output current, are analyzed to ensure that they are consistent with the frequency and phase of the grid voltage. The results obtained determine the efficiency and economic sustainability of the power electronics simulated and hence determine their scope in the future.

References :

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