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Modeling and Control of an Aerogenerator Utilizing DFIG and Multi-Level Converter Technology

Soukayna Tantani*, Mohamed Bezza, Sara Sghiouri

Electrical Engineering, Faculty of Science and Technology, Mohammedia, Morocco

Email address:

Soukayna.tantani@gmail.com (Soukayna Tantani), mohamed.bezza@fstm.ac.ma (Mohamed Bezza), sara.ssghiouri@gmail.com (Sara Sghiouri)

*Corresponding Author

Abstract

This paper explores the modeling and control of an aerogenerator system integrating a Doubly Fed Induction Generator (DFIG) paired with advanced multi-level converter technology. Multi-level converters are particularly suited to meet the high-performance demands of wind energy systems, providing improved power quality, reduced harmonic distortion, and increased energy efficiency. Utilizing vector control and maximum power point tracking (MPPT) techniques, this study aims to optimize wind energy extraction while ensuring system stability and responsiveness under varying wind speeds. Simulations conducted in MATLAB/Simulink validate the proposed approach, demonstrating significant improvements in dynamic performance and power quality fed into the grid. This work emphasizes the importance of multi-level converters in renewable energy applications, highlighting their potential to enhance the efficiency and reliability of wind power generation systems.

Keywords

Aerogenerator, Doubly Fed Induction Generator, Multi-Level Converter, Wind Energy, Power Quality, Harmonic Distortion, Energy Efficiency, Maximum Power Point Tracking