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Three-Level Converter in Offshore Wind Energy Systems: New Strategy for Unbalancing in Capacitors Voltage

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Abstract

This paper is on an offshore wind energy conversion system equipped with full-power three-level converter and permanent magnet synchronous generator. Multi-level converters, namely three-level converters, are limited by unbalance voltage in the direct current link capacitors. A new control strategy for the selection of the output voltage vectors is proposed in order to improve balance of voltage in the capacitors.

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Keywords: Wind energy; variable speed; three-level converter; unbalanced voltage; modeling; simulation

1. Introduction

The demand for energy, the shortage of fossil fuels and the need for carbon footprint reduction have resulted in a global awareness of the importance of energy savings and energy efficiency [1]. The economic feasibility of offshore wind energy capturing depends on the favorable wind conditions on offshore as compared to sites on onshore or on the availability of land for onshore wind farm. The higher average wind speed available over sea waters [2] have to convey an economic value for offshore developments such that at least compensation is achieved for the additional cost, including an estimate for the operation and future maintenance costs. Also, if the feasibility on onshore is deeply compromised by the infeasibility on the use of land space, the exploitation offshore might be promising.

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