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Research Article

Design and Analysis of Grid Voltage Oriented Sliding Mode Control for DFIG under Balanced and Unbalanced Grid Faults

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A B S T R A C T

This Doubly Fed Induction Mills (DFIGs) are widely utilized in variable-velocity windmills despite the nicely frequent overall performance of DFIGs, those mills are particularly realistic to grid faults. Therefore, the presence of grid faults ought to be taken into consideration inside the layout of any managed device to be deployed on DFIGs

Keywords: Doubly Fed Induction Mills (DFIG), SMC, VSCF

Introduction

DFIG is the maximum usually used electric device in wind generation. It offers great performance in restrained variety pace programs with the main benefit of partly rated strength converter, but this gadget is particularly touchy to voltage variations for the reason that stator is hooked up at once to the electric grid. While mutual flux is altered, torque oscillations can also appear critically affecting blades shaft and transmission machine. If the rotor-side controller isn't always appropriate for running under disturbances, the stator currents may additionally turn out to be non-sinusoidal compromising stability of the electric grid. In several countries, fault experience-thru functionality has become obligatory within the interconnection of new era devices. The better the penetration of wind generators the stricter the technical standards for mills interconnection have to be. Those necessities, called grid codes, cowl voltage operating range, electricity component regulation, frequency operating variety, grid aid functionality, and low fault trip via functionality.[1,2] Cutting-edge grid codes require the generator to stay connected for the duration of voltage dips and inject reactive power to repair the electric grid.[1,2] Furthermore, after the clearance of the fault, active electricity injection is required for electric frequency assist [three]. For DFIG, an abrupt voltage variation reasons a natural flux in the stator that could set off over-voltages inside the rotor windings that might affect on or even spoil the electricity converter.[1,2] Therefore, the use of a crowbar or another safety device is vital for excessive voltage dips. However, as soon as the modern has decreased, the injection of demagnetizing current can be used for restoring quicker the stator flux to its imperative position and hold with reactive energy contribution to the grid,

improving temporary reaction of the generator underneath natural flux.[5] Feedback management is a useful opportunity to improve the overall performance of DFIG turbines in presence of electric faults because it's far feasible to face low-intensity faults without disconnecting the generator from the grid.[6,7] SMC is a strong technique capable of offering insensitivity in opposition to bounded disturbance/ uncertainties and finite-time convergence. Doubly-fed electric-powered machines also slip-ring turbines are electric motors or electric mills, where both the sector magnet windings and armature windings are one by one linked to device out of doors the machine. The Doubly-Fed Induction Generator (DFIG) system is a famous machine in which the power digital interface controls the rotor currents to acquire the variable pace vital for optimum energy seize in variable winds.

Problem Definition

After clearance of the fault, active power injection is required for electric frequency support. For DFIG, an abrupt voltage variation causes a natural flux in the stator that may induce over-voltages in the rotor windings that could affect or even destroy the power converter. Therefore, the use of a crowbar or another protection device is necessary for severe voltage dips. However, once the current has decreased, the injection of demagnetizing current can be used for restoring faster the stator flux to its central position and continue with reactive power contribution to the grid, improving transient response of the generator under natural flux.

Methodology

This work can adopt a research methodology that mixes the idea model with empirical analysis and refinement of the planned theme on MATLAB simulation tool. MATLAB could be helpful in high-level development surroundings for systems that need mathematical modeling, numerical computations, information analysis, and improvement ways. MATLAB is a useful high-level development environment for systems that require mathematical modeling, numerical computations, data analysis, and optimization methods. This is because MATLAB consists of various toolboxes, specific components, and a graphical design environment that helps to model different applications and build custom models easier. Moreover, the visualization and debugging features of MATLAB are simple. A simulation model of the system is developed in MATLAB environment and simulation results are presented based on several conditions.

Results

The results obtained using MATLAB software is mentioned below:

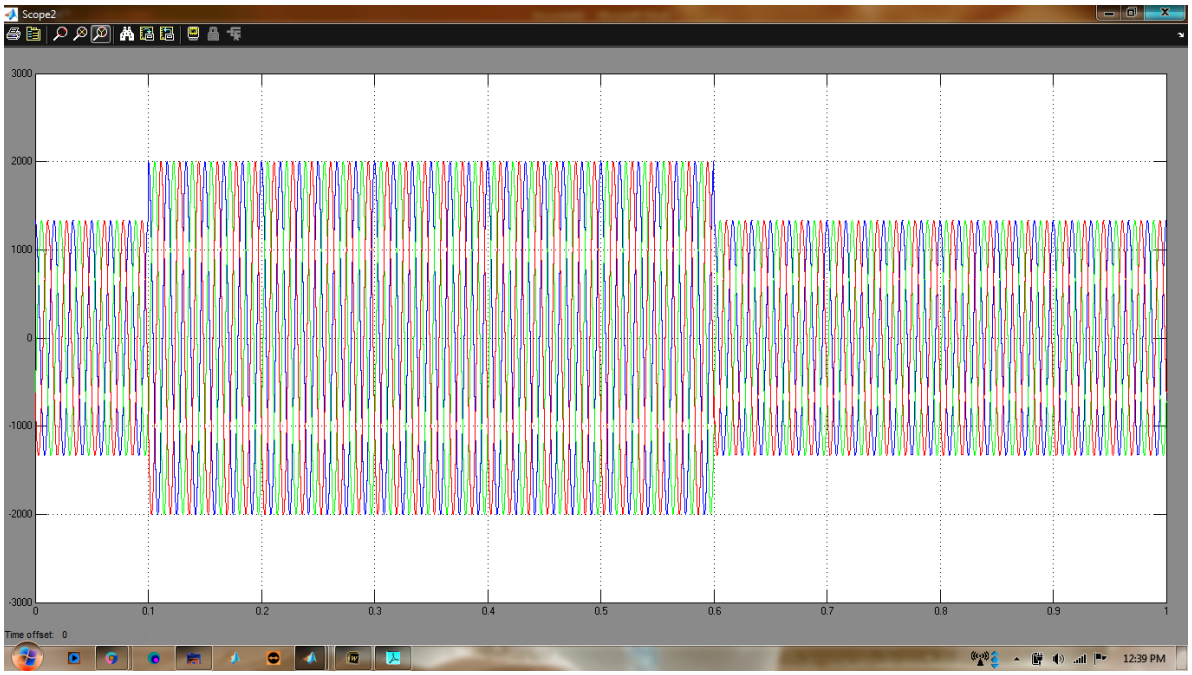

Figure 1.Current

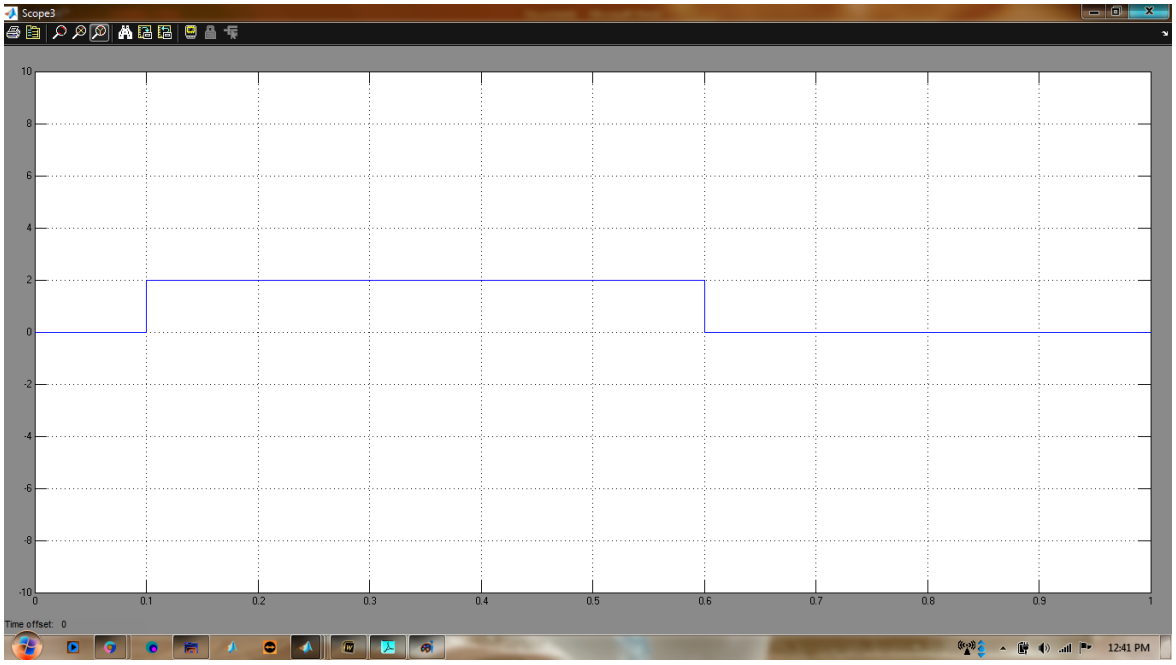

Figure 2.Qs

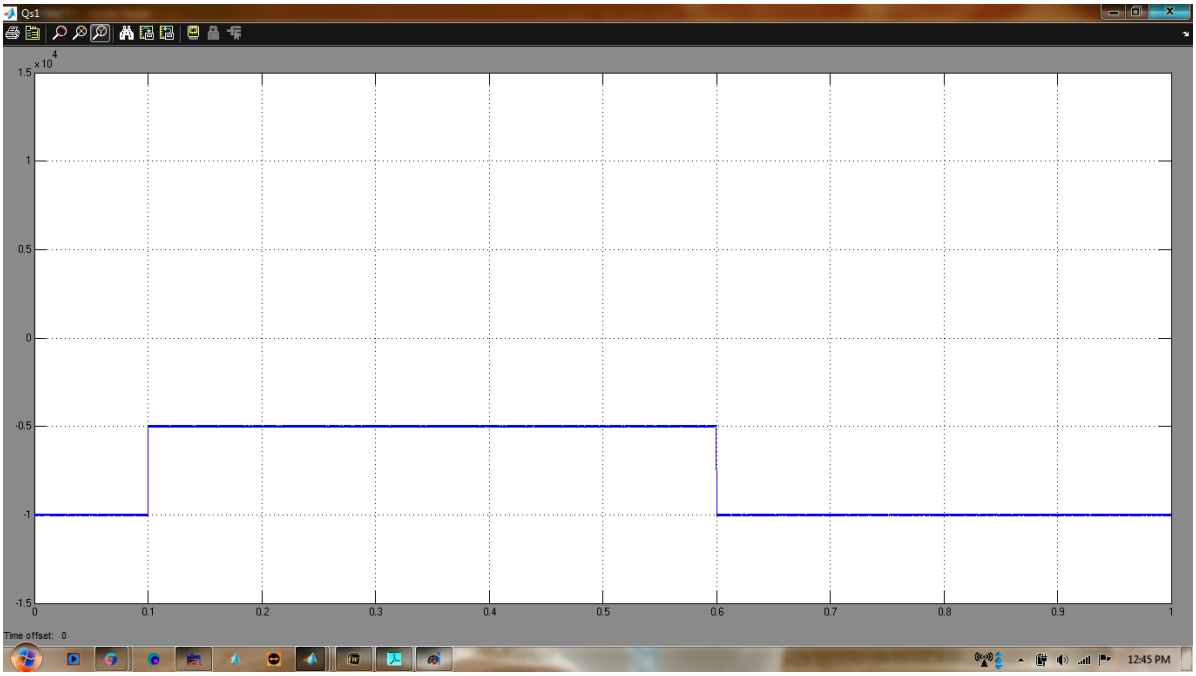

Figure 3.Torque

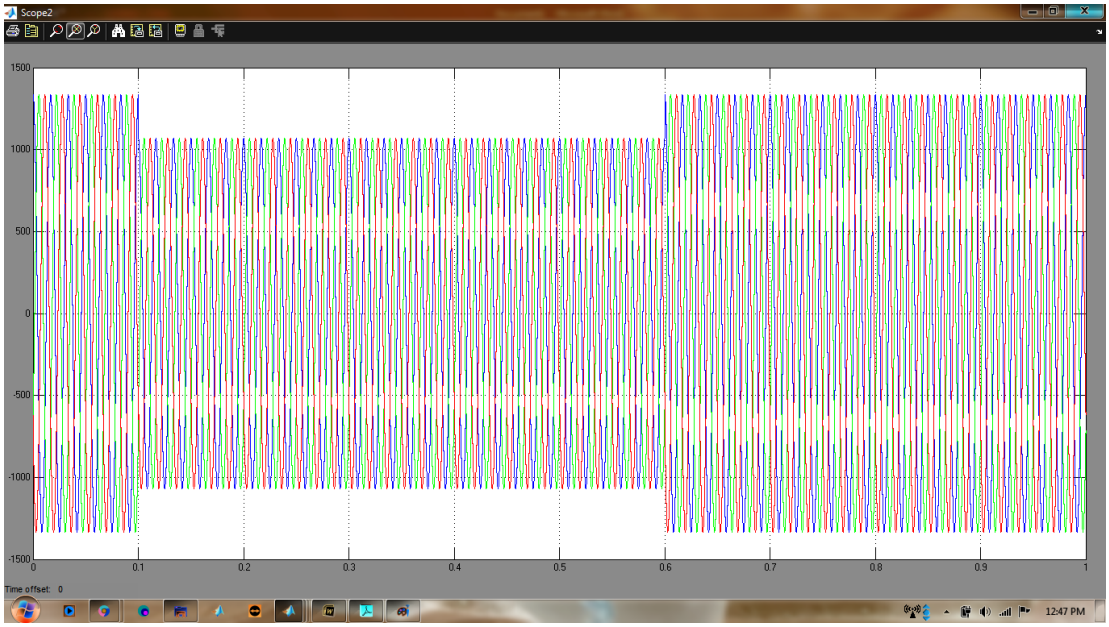

Figure 4.Voltage

Conclusion

A grid-voltage-oriented sliding mode control for DFIG is presented and tested under voltage dips. The controller has the main advantages of simple structure, no dependence on system parameters, and switching of power electronic devices directly from the controller output signals.

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