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RESEARCH ARTICLE

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IMPLEMENTATION OF NEW STATCOM CONTROL SCHEME FOR POWER QUALITY IMPROVEMENT IN WIND FARM

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ABSTRACT

Fixed speed induction generator (FSIG) having high asymmetrical fault share than variable speed. Even supposing there are a unit other ways to manage these faults STATCOM control technique to compensate reactive power is one among the helpful and extremely helpful ways. During this paper the FSIG wind park is discovered lower unbalanced grid fault with STATCOM connected to that with the assistance of MATLAB simulation and theory. MATLAB simulation for open loop system is disbursed and control system STATCOM management simulation is beneath method. Please embody a short abstract here. The fault is cleared once STATCOM is connected to system i.e. positive and negative sequence of the grid voltage is salaried. Negative sequence compensation is beneficial for reducing torsion oscillations. The soundness of FSIG Wind Park may be improved by this technique.

Keywords: Matlab/Simulink, wind energy, Induction generator, low-tension ride through, STATCOM

I. INTRODUCTION

Fixed speed system is that the straightforward system arrangement utilized in wind park sites. They operate at constant (or nearly constant) speed. Currently technology is dynamic mounted and development is moving from fixed speed to variable speed. However tendency to can't neglect share of mounted speed induction generator turbine as wind energy is one among the necessary supply of energy among property energy sources. There's V-J Day turbine still area unit mounted speed kind that we have a tendency to can't neglect. No matter is that the premium mobile speed; the angular speed of the rotor is mounted and is set by grid offer frequency and equipment magnitude relation. This is often straightforward and reliable construction of the electrical half whereas the mechanical elements area unit subject to higher stresses and therefore some extra safety factors have to be compelled to be enforced within the mechanical style. During this arrangement we are able to use induction generator (IG) and also the wound rotor synchronous generator (SG) because the electrical machine. However because of the simplicity, high potency and low maintenance necessities the cage induction generator has been the primary selection. To atone for the reactive power consumption of the induction generator and so as to get regarding unity power issue, a electrical condenser bank (normally stepwise controlled) is inserted in parallel with the generator. Further, a soft starter is employed to scale back the mechanical stress and to scale back the interaction between offer grid and rotary engine throughout

affiliation and to start out the rotary engine. The most advantage of this technique is that it's a straightforward and reliable arrangement. However, capacitors have to be compelled to be cut in or cut-off frequently to keep up power issue. This random shift offers rise to undesirable transients within the line currents and voltages. The fluctuations in primum mobile speed area unit regenerate to torsion pulsations that cause mechanical stress. This causes breakdown of drive train and equipment box. The ability generated from this arrangement is sensitive to fluctuations in premium mobile speed. FSIGs don't have the aptitude of freelance management of active and reactive power that is their main disadvantage. Their nice advantage is their straightforward and strong construction that ends up in lower opportunity cost. In distinction to different generator topologies, FSIGs provide no inherent suggests that of torsion oscillation damping that places larger burden and price on their casing. FSIG can't glad grid code demand while not connecting extra devices as a result of them can't offer reactive power management. throughout fault conditions (e.g. voltage dips) the mounted speed induction generator might consume high reactive power as their speed changes from synchronous speed, therefore voltage might collapse hugely and fault can produce in more network. STATCOM will offer best fault management ride, stability of the system and grid code necessities than the other investigated ways like pitch management of the rotary engine, extra device like energy storage systems or break chopper. In STATCOM electrical phenomenon or inductive current may be controlled freelance of AC bus voltage; it's a voltage supply device. Once throughout fault condition system voltage collapse suddenly STATCOM will offer the minimized voltage by injecting electrical phenomenon reactive power. As compare to different unbalance grid faults area unit occurred in majority. it should cause unbalanced heating within the machine windings and torsion pulsation will cause mechanical vibrations and acoustic noise. And thence STATCOM management structure is employed for these unbalanced conditions and to regulate positive and negative sequence voltage control.

II.RELATED WORK

WIND energy is like a key role on the approach toward a property energy future. Among the generator sorts used for wind turbines, the technical development has captive from fixed-speed to variable-speed ideas. though a serious a part of the new put in wind turbines square measure of the variable speed sort victimization either a doubly fed induction generator (DFIG) or permanent-magnet synchronous generator, a no negligible share of V-J Day of the in operation wind turbines in Europe in 2010 continues to be of the fixed-speed induction generator (FSIG)-type directly connected to the grid. As a result of this generator sort cannot offer reactive power management, it cannot fulfill the exacting grid code necessities while not extra devices. Throughout voltage dips, the induction generators might consume an outsized quantity of reactive power as their speed deviates from the synchronous speed, which might result in a voltage collapse and more fault propagation within the network. Completely different ways are investigated to boost the fault ride-through capability and to fulfill grid code necessities. Besides victimization the pitch management of the rotary engine or putting in extra instrumentation sort of a brake chopper or an energy storage system, the installation of a STATCOM has been known to produce the most effective dynamic stability sweetening capabilities. A STATCOM could be a voltage supply converter-based device providing dynamic reactive power support to the grid. Structure or star convertor topologies square measure typically chosen to implement the high-octane converters. Attributable to its versatile dynamic management capabilities, the STATCOM will facilitate to integrate alternative energy plants in an exceedingly weak installation. The aptitude of a static compensator compared to a STATCOM to extend the soundness of FSIG-based wind turbines is given. The STATCOM may perform an indirect force management for constant quite generators to decrease the mechanical stress throughout grid voltage dip.

All these investigations have lined balanced grid faults; however the bulk of grid faults square measure of the unbalanced nature. The unbalanced-voltage drawback will cause unbalanced heating within the machine windings and a rhythmic force,

resulting in mechanical vibration and extra acoustic noise. The STATCOM management structure is custom-made to those unbalanced-voltage conditions, and therefore the positive and therefore the negative sequence of the voltage is controlled severally. Completely different current injection ways supported symmetrical parts may be applied to the STATCOM, leading to completely different output-power distributions. However these completely different current injection targets have an effect on the operation of an FSIG-based wind park is investigated. However, concerning the damping of the force ripple of the generators, it's more practical to manage the positive- and therefore the negative-sequence voltage. A voltage equalization management of a STATCOM connected to induction motors is bestowed. The negative-sequence voltage management may be performed by a DFIG wind park within the section of the FSIG primarily based wind park. So far, however, no studies are found on the coordination between the positive- and therefore the negative-sequence voltage management of a STATCOM at an FSIG-based Wind

III.PROPOSED SYSTEM

Proposes the applying of a STATCOM that's connected to AN FSIG-based wind and accustomed management the positive- and therefore the negative-sequence voltage throughout grid faults. The novel contribution of this paper lies within the coordination of the positive- and therefore the negative-sequence voltage management by the STATCOM and therefore the connected result on the turbine behaviour. Whereas the positive-sequence voltage compensation ends up in AN increased voltage stability of the wind, the negative sequence voltage compensation ends up in a discount of force ripple, increasing the life of the generator drive train. But here, deeper analysis and activity results square measure bestowed

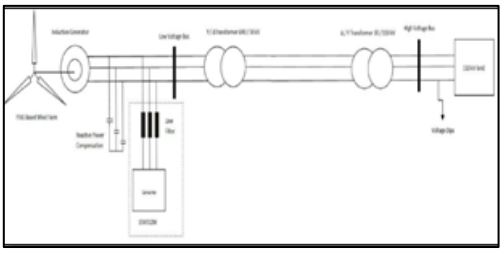


Fig. 1. Projected structure

The investigated resource is shown in Fig. one and consists of a 50-MW wind park with cage induction generators directly connected to the grid and a 50-MVA STATCOM. Associate degree combination model of the wind park is employed as was common here, which implies that the total of the turbines is modeled united generator victimization the quality T-equivalent circuit. The STATCOM is modeled as controlled voltage sources. Each devices square measure connected to constant low voltage bus so connected to the medium voltage bus by a electrical device. The medium voltage level is connected to the high voltage level by a second electrical device. Each transformers square measure rated for the total of the Wind Park and STATCOM power and have a series electrical resistance of fifty and 100 percent per unit. The grid fault is assumed at the high voltage level of the grid that is modeled by its Thevenin equivalent.

REGULATION OF STATCOM

Proposed management structure of the STATCOM to regulate positive and negative sequence voltage severally The STATCOM management structure is predicated on a voltage homeward-bound vector control as sometimes applied to 3 part grid connected converters. It's a cascade management structure with inner PI current controllers during a rotating dq arrangement with grid voltage orientation. Resonant managementlers tuned at one hundred cycles per second within the same positive dq arrangement square measure additional to understand the negative sequence current control. Note, that the management of the negative sequence currents can even be performed during a negative rotating arrangement with PI controllers, however by victimization resonant controllers during a positive rotating arrangement there's no want for a sequence separation of the currents. the management structure is shown in Fig. 2. Note, that a potential STATCOM power circuit is shown here as a voltage supply device connected to the grid by associate degree LCL filter, whereas the STATCOM is modeled as a 3 part controlled voltage supply within the simulations neglecting the change behaviour. The outer management loops square measure designed to regulate the DC voltage and also the positive and negative sequence of the voltage at the affiliation purpose of the STATCOM.

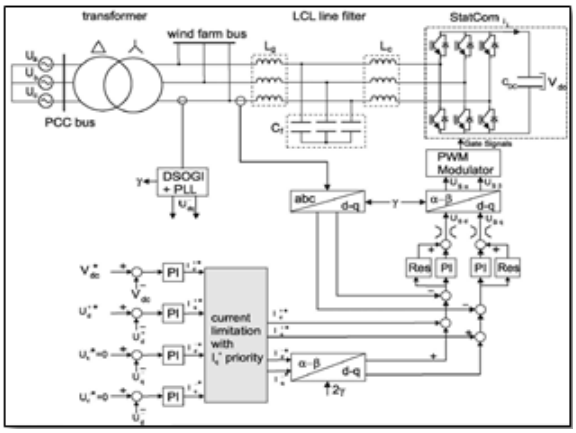
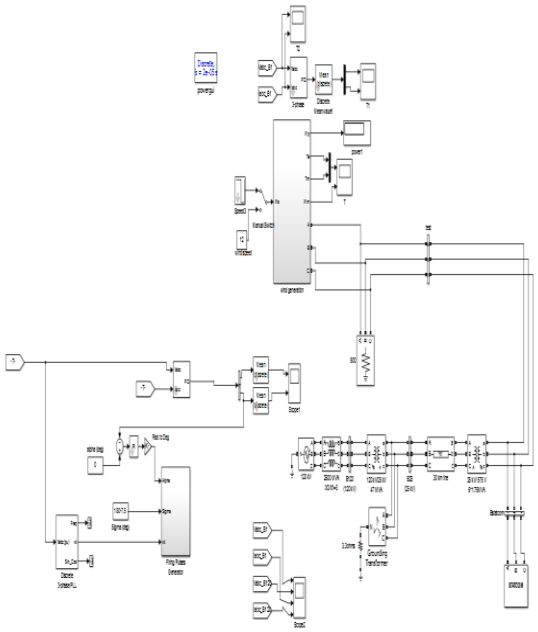


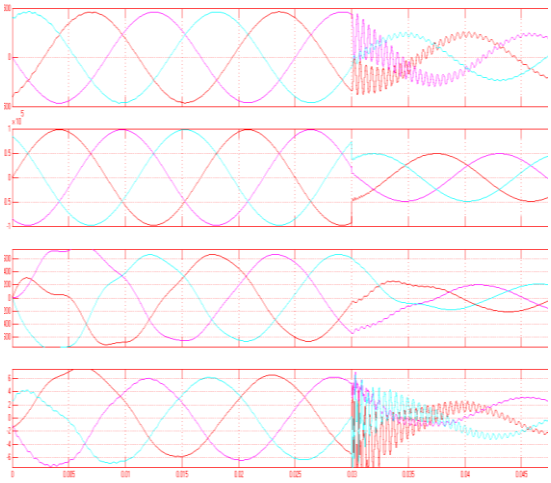
Fig. 2. Projected management structure of the STATCOM

Fiure 2 Projected management structure of the STATCOM to regulate the positive- and also the negative-sequence voltage severally. Therefore a definite sequence separation of the measured voltage into positive and negative sequence parts are important, that is performed supported twin second order generalized integrators. Victimization the sequence separation the positive and negative sequence of the voltage seems as DC values and might be controlled by PI controllers. To confirm a secure operation of the STATCOM among its current capability this references given by the four outer controllers should be restricted to the utmost STATCOM current. The priority is on the positive sequence reactive therefore, the STATCOM ensures the utmost fault ride through improvement of the wind park by compensating the positive sequence voltage. If there's a remaining STATCOM current capability the STATCOM is controlled to compensate the negative sequence voltage to boot, so as to scale back the force ripple throughout the grid fault. The positive and negative sequence current references square measure additional. Note, that the negative sequence currents references should be reworked into the positive rotating arrangement by a coordinate transformation with double the grid voltage angle.

SIMULATION RESULT

MATLAB simulation is carried with STATCOM management structure shown in Fig.2. Fault current is obtaining stable when connecting STATCOM to wind park system.





CONCLUSION

Positive sequence and negative sequence current wave of grid beneath unbalance third part fault is with STATCOM and while not STATCOM square measure studied in previous sections. The projected structure controls the positive and also the negative sequence of this severally with priority on the positive-sequence current. The positive-sequence voltage compensation ends up in associate degree enhanced voltage stability of the wind park, the negative-sequence voltage compensation ends up in a discount of force ripple, increasing the life of the generator drive train.

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