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A NOVEL REPRESENTS SCHEME FOR INTEGRATING OF WIND ENERGY GENERATION SYSTEM TO IMPROVE POWER QUALITY BY USING STATCOM

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ABSTRACT:

At the point when the wind force is associated with an electric matrix influences the force quality. The impacts of the force quality estimations are-the dynamic force, receptive force, variety of voltage, gleam, sounds, and electrical conduct of exchanging operations. The establishment of wind turbine with the matrix causes power quality issues are controlled by concentrating on this paper. For this Static Compensator (STATCOM) with a battery vitality stockpiling framework (BESS) at the purpose of basic coupling to alleviate the force quality issues. The matrix associated wind vitality era framework for force quality change by utilizing STATCOM-control plan is mimicked utilizing SIMULINK as a part of force framework piece set. This remembers the primary supply source from the receptive force interest of the heap and the impelling generator in this proposed plan. The change in force quality on the framework has been introduced here as indicated by the rules determined in IEC-61400 standard (International Electro-specialized Commission) gives a few standards and estimations. List terms: - International Electro-specialized Commission (IEC), power quality, wind producing framework (WGS), STATCOM.

Keywords: D-STATCOM, Total harmonics Distortion (THD, Voltage Sag/swell, Voltage Source Converter (VSC).

1. INTRODUCTION:

One of the fundamental issues in wind vitality era is the association with the framework. Infusion of wind force into the matrix influences the force quality bringing about poor execution of the framework. The wind vitality framework confronts every now and again fluctuating voltage because of the way of wind and presentation of sounds into the framework. Infusion of the wind power into an electric matrix influences the force quality. While fossil powers will be the principle powers for warm power, there is a trepidation that they will get depleted in the end in the following century. To have supportable development and social advancement, it is important to meet the vitality need by using the renewable vitality assets like wind, biomass, hydro, co-era and so on. In practical vitality framework, vitality

protection and the utilization of renewable source are the key worldview. The need to incorporate the renewable vitality like wind vitality into force framework is to minimize the ecological effect on ordinary plant. With the assistance of exceptional gatherers, we can catch a part of this vitality and put it to use for our electrical power supply needs. For whatever length of time that daylight, water and twist keep on streaming and trees and different plants keep on developing, we have entry to a prepared of supply of vitality. In this proposed plan Static Compensator (STATCOM) is associated at a state of basic coupling with a battery vitality stockpiling framework (BESS) to moderate the force quality issues. The battery vitality stockpiling is coordinated to support the genuine force source under fluctuating wind power. The STATCOM control plan for the matrix associated wind vitality era framework for force quality change is reproduced utilizing MATLAB/SIMULINK in force framework square set. The adequacy of the proposed plan eases the principle supply source from the receptive force interest of the heap and the prompting generator. It is likewise having capacity of consonant end and load adjusting. The proposed STATCOM control plan for matrix associated wind vitality era for force quality change has taking after destinations[1].

1) Unity force element at the source side and in addition Reactive force support from STATCOM to wind generator and burden.

2) Simple blast controller for STATCOM to accomplish quick element reaction.

3) Reduction in THD in source current which makes other burden on line to be protected.

II. TOPOLOGY FOR POWER QUALITY IMPROVEMENT

The STATCOM based current control voltage source inverter infuses the current into the lattice will counteract the receptive part and symphonious part of the heap and incitement generator current, in this manner it enhances the force variable and the force quality. To finish these objectives, the framework voltages are detected and are synchronized in producing the current.

The proposed framework associated framework is executed for force quality change at purpose of regular coupling (PCC), for network associated framework in Fig.

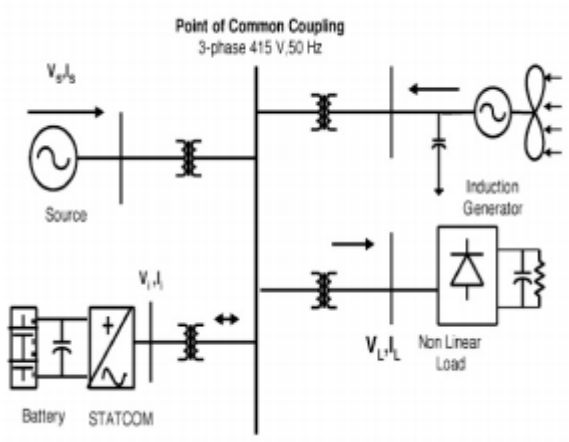


Fig.1. Grid connected system for power quality improvement.

A. WIND ENERGY GENERATING SYSTEM:

In this configuration, wind generations are based on constant speed topologies with pitch control turbine.

The induction generator is used in the proposed scheme because of its simplicity, it does not require a separate field circuit, it can accept constant and

variable loads, and has natural protection against short circuit.

The available power of wind energy system is presented as under in Eq.6.

$$P_{wind} = \frac{1}{2}\rho A V_{wind}^3 \quad (6)$$

Where ρ (kg/m) is the air density and

A (m) is the area swept out by turbine blade,

V wind is the wind speed in mtr/s.

It is not possible to extract all kinetic energy of wind, thus it extract a fraction of power in wind, called power coefficient Cp of the wind turbine, and is given in Eq.7

$$P_{mech} = C_p P_{wind} \quad (7)$$

Where Cp is the power coefficient, depends on type and operating condition of wind turbine. This coefficient can be express as a function of tip speed ratio γ and θ pitch angle. The mechanical power produce by wind turbine is given in Eq. 8.

$$P_{mech} = \frac{1}{2}\rho \Pi R^2 V_{wind}^3 C_p \quad (8)$$

Where R is the radius of the blade (m).

III. WIND ENERGY SYSTEMS

Wind vitality has the greatest offer in the renewable vitality segment [1], [3]. In the course of recent years, framework associated wind limit has dramatically increased and the expense of force created from wind vitality based frameworks has lessened to one-6th of the comparing esteem in the mid 1980s [3]. The imperative elements connected with a wind vitality change framework are:

- Available wind vitality
- Type of wind turbine utilized
- Type of electric generator and force electronic hardware utilized for interfacing with the lattice.

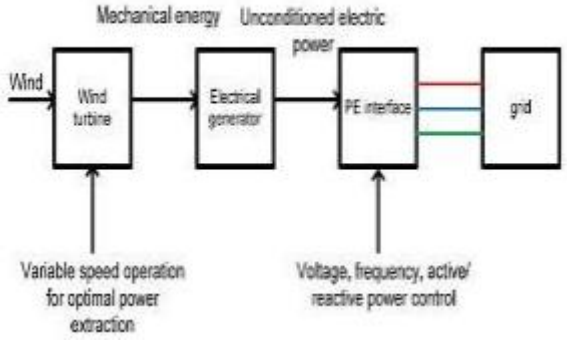


Fig. 1 Variable speed wind energy conversion system

Wind vitality – Wind speeds, pneumatic force, climatic temperature, earth surface temperature and so on., are exceedingly between connected parameters. Because of the innate intricacy, it is impossible to expect a careful material science based expectation philosophy for wind force/supportability. Be that as it may, circulation based models have been proposed, and utilized to anticipate the manageability of wind vitality change frameworks [4]. Nitty gritty clarification of the wind vitality assets is past the extent of this paper. In view of studies it has been accounted for that the variety of the mean yield power from a 20 year period to the following has a standard deviation of under 0.1 [4]. It can be finished up with sensible certainty that wind vitality is a tried and true wellspring of clean vitality.

In light of the streamlined guideline used, wind turbines are characterized into drag based and lift based turbines. In light of the mechanical structure, they are characterized into even hub and vertical hub wind turbines. Concerning the turn of the rotor,

wind turbines are arranged into settled velocity and variable rate turbines. In a matter of seconds the attention is on flat hub, lift based variable pace wind turbines [2], [3]. Power electronic circuits assume an essential empowering part in variable velocity based wind vitality change frameworks.

Settled velocity wind turbines are easy to work, dependable and hearty. However the velocity of the rotor is altered by the network recurrence. As result, they can't take after the ideal streamlined proficiency point. If there should arise an occurrence of changing wind speeds, altered rate wind turbines can't follow the ideal force extraction point.

In variable velocity wind turbines, power electronic hardware in part or totally decouples the rotor mechanical recurrence from the lattice electrical recurrence, empowering the variable pace operation. The sort of electric generator utilized and the matrix conditions manage the prerequisites of the force electronic (PE) interface. Fig. 1 delineates a variable pace wind vitality transformation framework. The electrical generator famously utilized for somewhat variable pace wind vitality change frameworks are doubly-sustained inductiongenerators [5]. Fig. 2 delineates a doubly-fedinduction-generator where the rotor circuit is controlled by the force converter framework by means of the slip rings and the stator circuit is associated with the network. This technique is profitable as the force converter needs to handle a division ~ 25% - 50 % of the aggregate force of the framework [5]. The force converter framework utilizes a rotor side air conditioning dc converter, a dc join capacitor, and a dc-air conditioning inverter associated with the lattice as appeared in Fig.

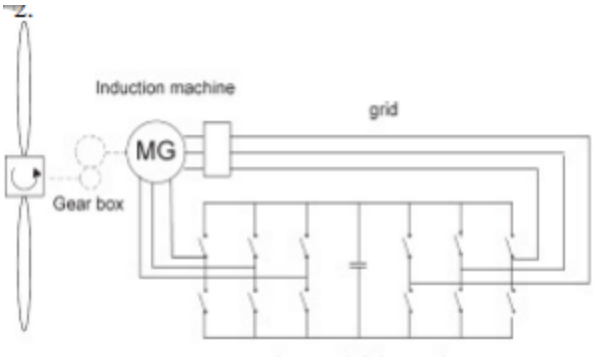


Fig. 2. Limited range, variable wind energy conversion system

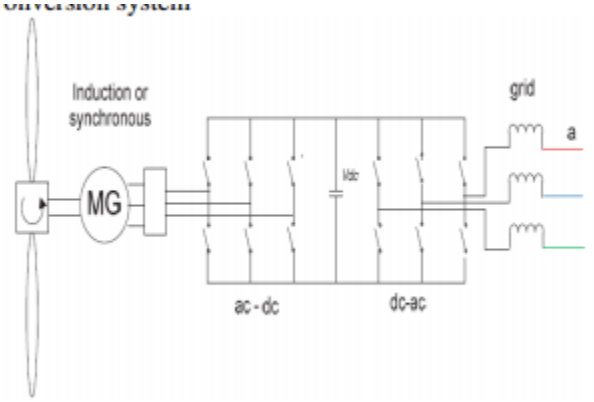


Fig. 3. Fully variable wind energy conversion system

The rotor side converter controls the rate and torque of the rotor and the stator side convertor keeps up a consistent voltage over the dc join capacitor, independent of the size of the rotor power. This strategy is more productive than the altered velocity framework; in any case it doesn't mirror the conceivable ideal effectiveness.

By utilizing a full scale air conditioning air conditioning converter framework the wind turbine can be totally decoupled from the lattice, empowering a more extensive scope of ideal operation. Such a plan is delineated in Fig. 3. The variable recurrence air conditioning from the turbine

is encouraged to the three stage air conditioning dc-air conditioning converter. The generator side air conditioning dc converter is controlled to acquire a foreordained quality at the terminal of the dc join capacitor. The dc voltage is then reversed utilizing a six-switch dc-air conditioning inverter. Reversal is naturally buck operation henceforth the turbine side acdc converter needs to guarantee adequate voltage level is acquired so as to incorporate with the lattice. In the event that extra boosting of the voltage is required, an extra dc-dc help converter can to be utilized. This builds the general expense and multifaceted nature. To beat the inadequacies a Z source inverter based change framework can be utilized [6]. Z source inverter is a generally new topology and has the accompanying preferences over the traditional voltage source/current source inverters:

• Buck help capacity

• Inherent short out insurance because of Zsource design

• Improved EMI as dead groups are not required

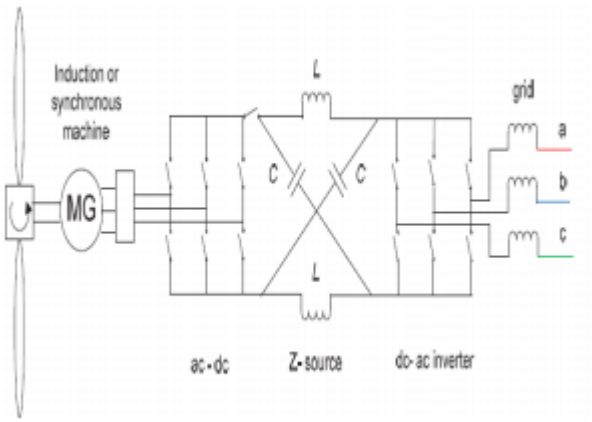


Fig. 4 Z-source based variable speed wind energy conversion system

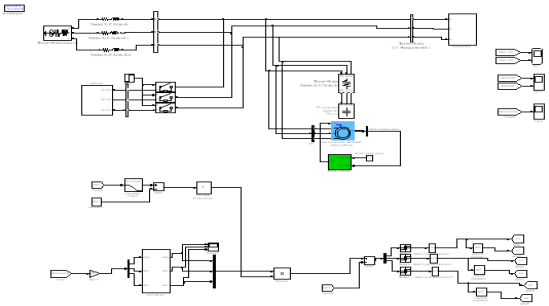
Z-source inverter based wind power conversion systems are relatively new, however researches are investigating its applicability. A Z-source converter based wind energy system has been studied and presented in [1]. Fig. 4 shows a Z-source based wind energy conversion system. A single stage three phase ac- ac Z-source converter is presented . Table I gives a qualitative summary of the wind energy conversion systems[6].

TABLE 1

Comparison of wind energy conversion systems

WEC based on	Generator	Grid integration	Key points
Fixed speed system	Induction generator	Direct	Constant speed Simple Low controllability
Partially variable system	Doubly-fed-induction-generator	ac-dc-ac voltage source converter	Highly controllable Vector control of active and reactive power
Fully variable system	Induction generator or synchronous generator	ac-dc-ac voltage source converter or potentially Z-source converter	Highly controllable Wide range of speeds. For Z-source, Short circuit protection Improved EMI feature.

Simulation Results:



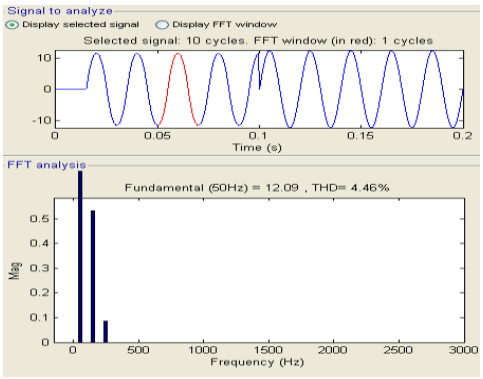


Fig3 and fig 4

Without dstatcom

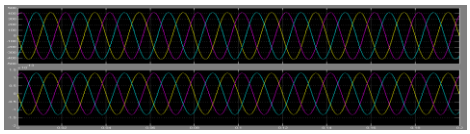
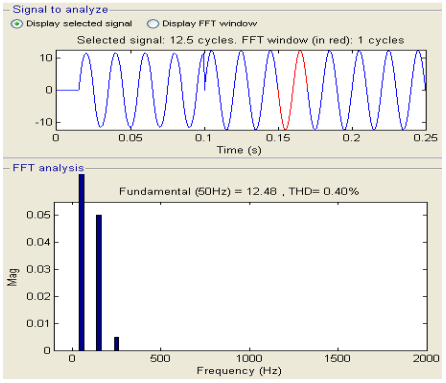


Fig:3 three phase out put voltage and current



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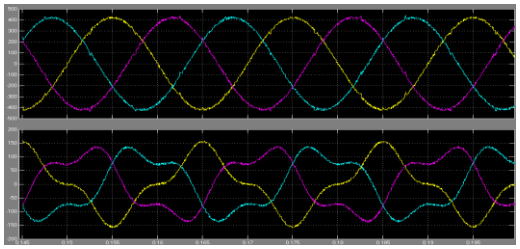
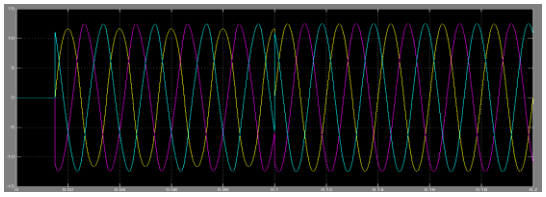
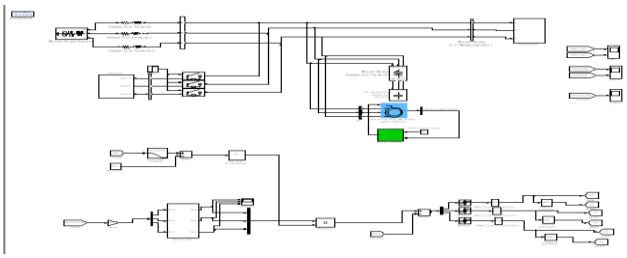


Fig.4 injected voltage and current





For fig 5 and fig 6

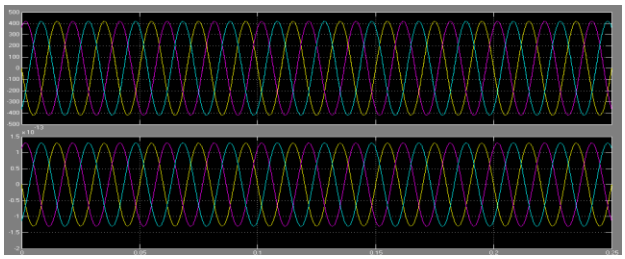


Fig5

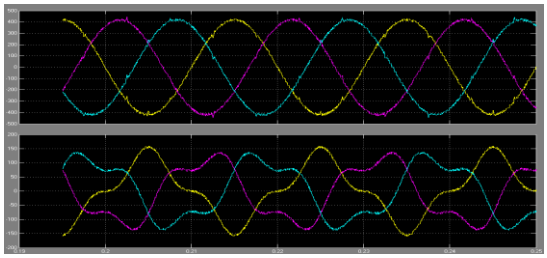
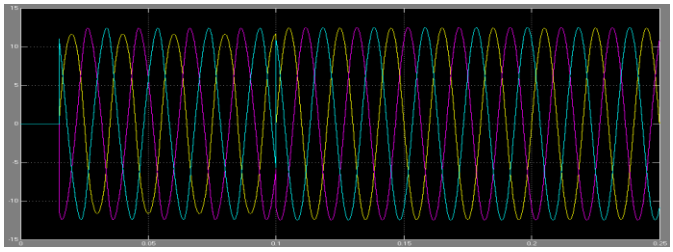


Fig6



IV CONCLUSION

The paper introduces the STATCOM-based control plan for force quality change in matrix associated wind producing framework and with burden as DC Motor. The force quality issues and its outcomes on the purchaser and electric utility are exhibited. The operation of the control framework produced for the STATCOM-BESS in MATLAB/SIMULINK for keeping up the force quality is recreated. It has a capacity to offset the symphonious parts of the heap current. It keeps up the source voltage and current in-stage and backing the receptive force interest for the wind generator and burden at PCC in the network framework, in this way it gives a chance to upgrade the use element of transmission line. The coordinated wind era and STATCOM with BESS have demonstrated the remarkable execution.

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