A Study on Reliability and Power Quality Enhancement in Wind Integrated Power System Using STATCOM

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***Abstract*—The electricity exceptional problem substantially due to set up of wind turbine with the grid. In this proposed scheme, a static compensator (STATCOM) is attached at a factor of common coupling with a battery electricity storehouse machine (BESS) to alleviate the energy first- class problems. The battery strength garage is included to sustain the factual strength source below shifting wind power. The STATCOM manipulation scheme for the grid- linked wind electricity period machine for excellent power development is dissembled using MATLAB/ SIMULINK in the power system block set. The effectiveness of the proposed scheme relies on the primary delivery sources being the reactive power demand of the burden and the induction creator. The enhancement of the grid collaboration rule and the scheme for enhancement in energy excellent morals as per IEC- preferred at the grid have been supplied.**

***Index Terms*—STATCOM, BESS, Matlab**

I. INTRODUCTION

Wind power is the conversion of wind energy into a useful form, similar to electricity, using wind turbines. Wind energy is directly used to crush grain or pump water. Wind energy is generous, renewable, extensively distributed, clean, and reduces greenhouse gas emissions when it displaces reactionary-energy-derived electricity. At the moment, the ultramodern energy industry faces a growing mindfulness regarding the impact of conventional power generation on the terrain. Issues such as limited reactionary energy reserves and climate change due to CO2 emigrations bring to light indispensable technologies to induce electricity in a more sustainable manner. The intermittency of wind infrequently creates invincible problems when using wind power to supply a low proportion of total demand, but it presents redundant costs when wind is to be used for a large amount of demand. The latest technological advancements in wind energy conversion and increased support from governmental and private institutions have led to increased wind power generation in recent times.

The security of a power system is regarded as the capability of the system to repel disturbances without causing a breakdown of the power system [8]. For wind power creators to contribute to the security of a power system, they must have the capability to contribute to both voltage and frequency control in stabilizing the power system following a disturbance; they must be suitable to ramp up or down to avoid insecure power system operation; they must be suitable to ride through disturbances expiring from the power system; they must be suitable to avoid redundant fault situations while still contributing to fault identification and concurrence; and they should be suitable to operate in islet mode when the force from the grid is lost[9]. Wind power generation is frequently faced with difficulties with respects to trust ability in terms of the generation, planning, and scheduling of the force of electricity (10). There's always a lack of confidence among the mileage drivers in the system's capability to meet peak demands. Although no electricity system is 100 percent dependable, intermittent generation will increase the position of query and, thus, the reserve capacity band of the power system, which in turn increases the generation costs. The effect is minimum at low penetration situations but could be challenging at high penetration situations [11, 12].

II. PROBLEM IDENTIFICATION

Wind power is the transformation of wind dynamism into a useful shape of dynamism, similar as utilizing wind turbines to make electrical authority. Wind authority is veritably harmonious from time to time but has significant variation over shorter time scales. As the proportion of wind authority in a region increases,

a want to upgrade the grid and a lowered capability to displant usual product can do. Now a day's one of the Main conclusions is Power Quality. The ultramodern device interpretation is veritably sensitive with the authority force quality and makes it's an important aspect. Power Quality case occurs when the voltage, current and frequency come nonstandard and end use outfit gets damage. The harmonics, indemnification of reactive authority and authority procurator is a main case dealt then. tallying to the guideline prescribed in International Electro-specialized Commission metric, IEC- 61400, by the measures and morals prescribed can determine the interpretation there by authority quality of a wind turbine. The active authority, reactive authority, voltage changes, film, harmonics, electrical geste of swapping operation are the concerning authority quality measures by the sequel of the wind turbine in the grid system. These amounts are measured grounded on public/ transnational guidelines. The authority electronic switching bias similar as adjustable AC Transmission System (Data) have been developed; preface of tricks authority bias and the technology of arising branch give an ultramodern control capability of authority system. This design work describes how the wind turbine installation creates authority quality case in grid system. In the proffered system in order to break the authority quality effects a battery dynamism storehouse system (BESS) connected by STATIC COMPENSATOR(STATCOM) at a common or garden point coupling. The real authority source under shifting wind authority is sustained by the integrated battery dynamism storehouse.

III. METHODOLOGY

STATCOM

In 1999 the first SVC with Voltage Source Converter called STATCOM (static compensator) went into operation. The STATCOM has a characteristic analogous to the coetaneous condenser, but as an electronic device it has no indolence and is superior to the coetaneous condenser in several ways, similar as better dynamics, a lower investment cost and lower operating and conservation costs. fig4.3.3. A STATCOM is make with Thyristors with turn- off capability like GTO or moment IGCT or with further and further IGBTs. The static line between the current limitations has a certain steepness determining the control characteristic for the voltage (10). In the distributed energy sector, the operation of Voltage Source Transformers for grid connection is common practice moment. The coming step in STATCOM development is the combination with energy warehouses on the DC- side. The performance for power quality and balanced network operation can be bettered much more with the combination of active and reactive power maintenance costs.fig 3.1

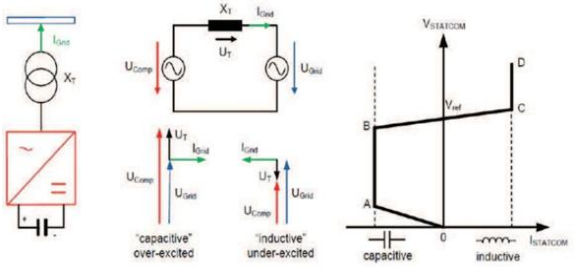


Fig. 3.1 Schematic Representation of STATCOM And Phasor Diagrams [25]

Basic Operating Principles Of STATCOM

The STATCOM is connected to the power system at a PCC (point of common coupling), through a step- up coupling motor, where the voltage- quality problem is a concern. The PCC is also known as the terminal for which the terminal voltage is UT. All needed voltages and currents are measured and are fed into the regulator to be compared with the commands. The regulator also performs feedback control and labors a set of switching signals (firing angle) to drive the main semiconductor switches of the power motor consequently to either increase the voltage or to drop it consequently. A STATCOM is a controlled reactive- power source. It provides voltage support by generating or absorbing reactive power at the point of common coupling without the need of large external reactors or capacitor banks. Using the regulator, the VSC and the coupling motor, the STATCOM operation is illustrated in figure below 3.2

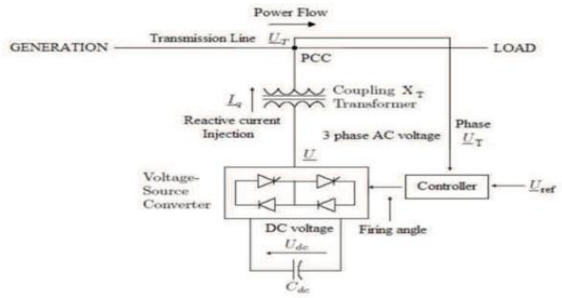


Fig. 3.2 STATCOM operation in a power system

The charged capacitor Cdc provides a DC voltage, Udc to the motor, which produces a set of controllables three- phase affair voltages, U in coincidence with the AC system. The coincidence of the three- phase affair voltage with the transmission line voltage has to be performed by an external regulator. The quantum of asked voltage across STATCOM, which is the voltage reference, Uref, is set manually to the regulator. The voltage control is thereby to match UT with Uref which has been developed. This matching of voltages is done by varying the breadth of the affair voltage U, which is done by the blasting angle set by the regulator. The regulator therefore sets UT original to the Uref. The reactive power exchange between the motor and the AC system can also be controlled. This reactive power exchange is the reactive current fitted by the STATCOM, which is the current from the capacitor produced by absorbing real power from the AC system as shown Fig. 3.3

The power of wind energy system is showing Fig.4.

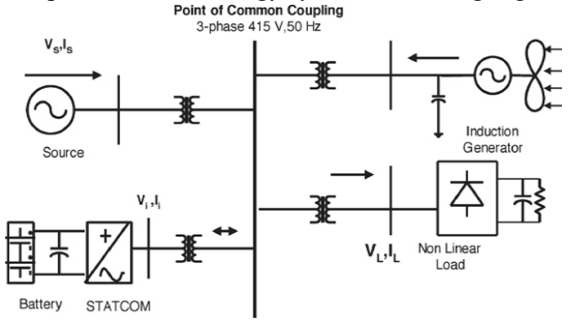


Fig 3.3. Grid connected wind energy system for power quality enhance.

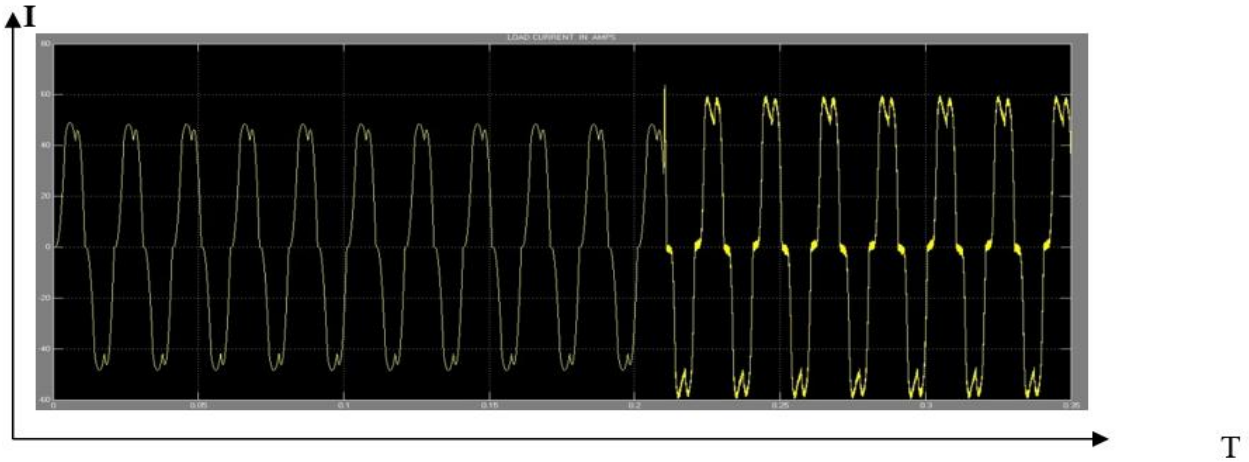
IV. RESULT & DISCUSSION

The performance of the device is measured by means of switching the STATCOM at different times inside the device and how the STATCOM responds to the step change command for an increase in redundant cargo at zero.22 s is proven in the simulation. When the STATCOM regulator is turned on without an alternate in every other cargo situation parameter, it starts off evolving to alleviate reactive calls in addition to harmonious ultramodern. The dynamic performance is likewise done via step alternate in a cargo while applied at zero.22 s. This redundant demand is satisfied by the STATCOM compensator. The simulation consequences are shown in the numbers below.

Table of findings: 5.

S.No.	Findings	Without STATCOM	With STATCOM
1	Power factor	0.92	0.925
2	THD of nonlinear loads	21.86%	14.06%
3	THD of current of wind generator	1.80%	1.78%
4	THD of current of source	2.85%	17.66%

Simulation Result I



I – with respect current ((-80 to 80 Amp)

T axis – with respect time (0-0.35 Sec)

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FFT Analysis

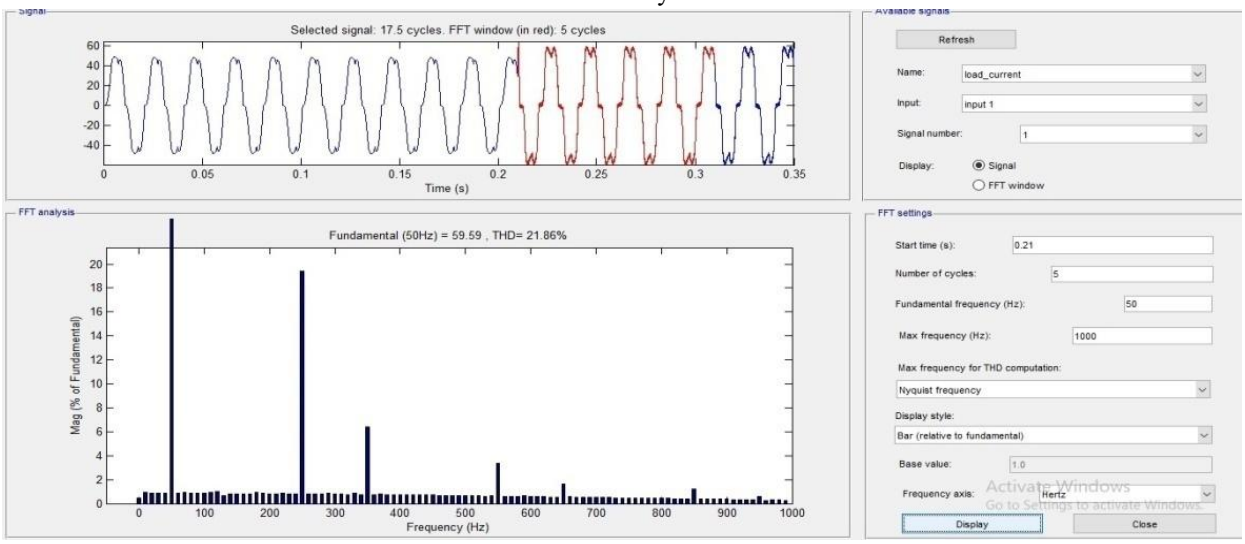

Fig No 5.3 FFT Analysis of Without STATCOM

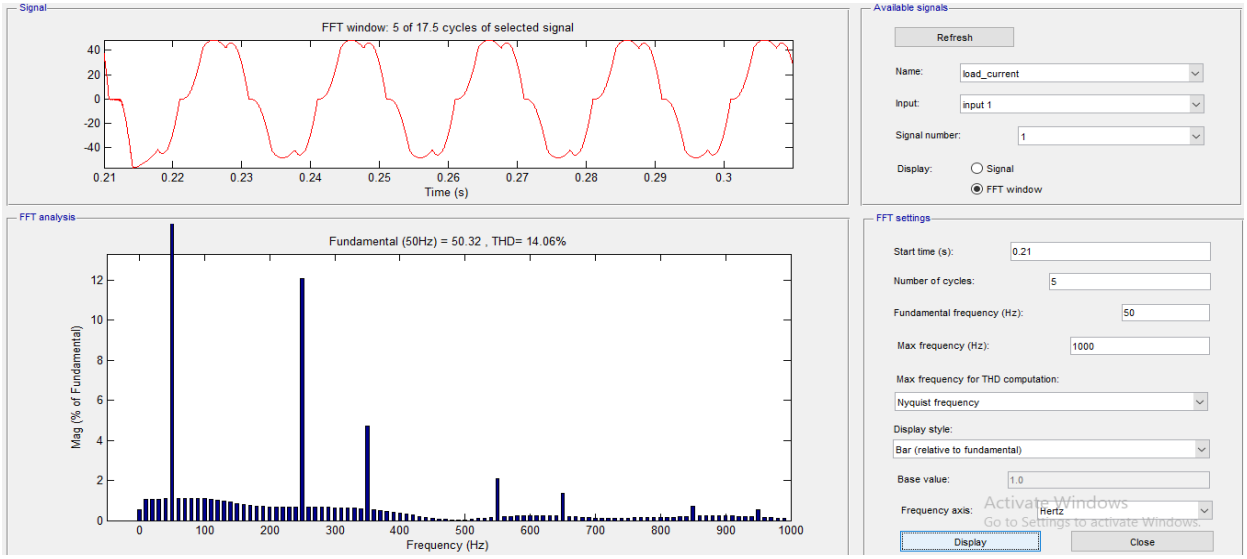

Fig no 5.4 FFT analysis of with STATCOM

FFT Analysis

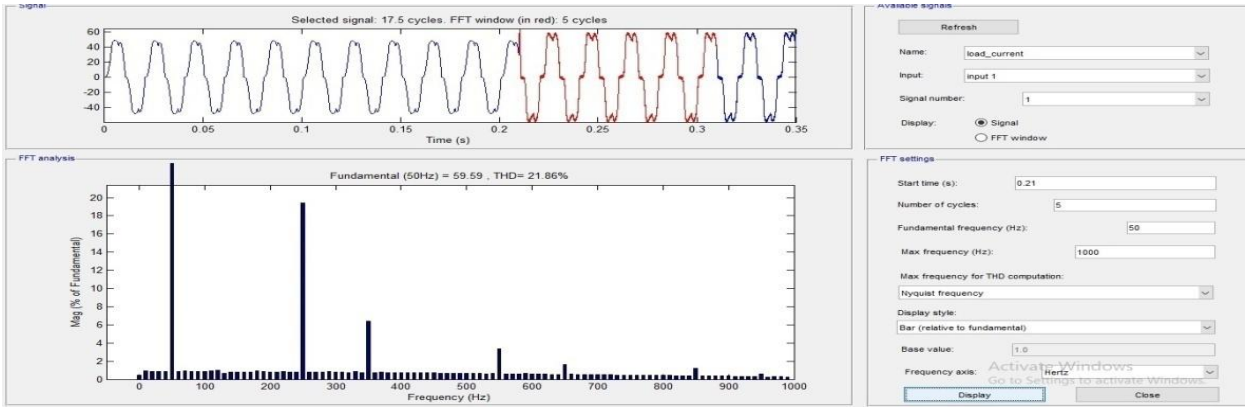

Fig No 5.3 FFT Analysis Of Without STATCOM

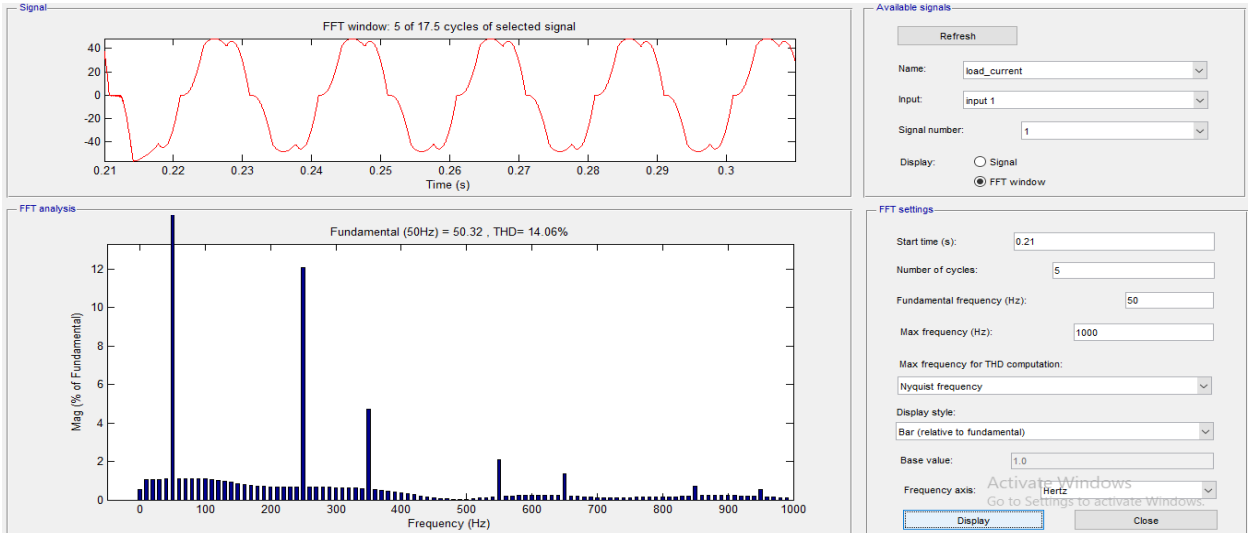

Fig no 5.4 FFT analysis of with STATCOM

V. CONCLUSION:

It is concluded that this project we gift the FACTS tool (STATCOM) -based manipulate scheme for power fine development in grid connected wind generating machine and with nonlinear load. The electricity best problems and its effects on the purchaser and electric powered utility are presented. The operation of the control gadget evolved for the STATCOM in MATLAB/SIMULINK for keeping the electricity satisfactory is to be simulated. It has a capability to cancel out the harmonic parts of the burden modern-day. It maintains the supply voltage and modern-day in-phase and guide the reactive power demand for the wind generator and load at PCC in the grid machine; hence it gives a possibility to decorate the usage issue of transmission line.

Thus, the included wind era and FACTS tool with BESS have shown the superb overall performance in retaining the voltage profile as in keeping with requirement. Thus, the proposed scheme in the grid connected machine fulfils the energy nice necessities and maintains the grid voltage unfastened from distortion and harmonics.

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