

Speed Control of Wind Using STATCOM and Voltage Controller in Wind Power Station

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ABSTRACT: At small propeller speeds, generator saturation confines voltage of DWIG. This paper survey improvement wind energy alteration efficiency at low wind speeds. Using a boost converter, advanced DC voltage can produce while DWIG functions at Maximum Power Point Tracking (MPPT) even at low speed and low voltage conditions. In this paper we will review about to Increase Speed Range of Dual-stator Winding Induction Generator in Wind Power Systems. STATCOM works as a inverter. Current of Boost converter changes speed of Wind Power Plant.

KEYWORDS: Dual Stator Winding, Wind Power, wind power generation.

I. INTRODUCTION

In recent years, because of quick utilization of fossil fuels and, expanding natural concerns, wind energy, as one of most generally used inexhaustible assets, has been drawing in an ever growing number of concerns. In 2012, around 282 430-MW wind power has been introduced everywhere throughout world, and it is expected that 10%–20% of the overall electrical power will be produced by wind vitality in 2030. As world moves toward more elevated amount of infiltration of wind vitality on lattice, there is an inclination to find the wind cultivates seaward, where wind condition is massively improved, and matters of commotion and influence on scene can be fairly developed. For the transmission of intensity from the seaward wind ranch to network association point, the decision is to be made between high-voltage air conditioning (HVAC) and high-voltage dc (HVDC). For most part, seaward wind ranches at separations under 120 km from shore and with limit under 150 MW could be associated with matrix utilizing HVAC transmission, though at longer removes as well as with higher limit, just HVDC transmission is relevant due to its monetary and specialized focal points.

A dual stator induction machine includes of a normal squirrel-confiner rotor and a stator with two distinct windings twisted for a divergent number of shafts. Every stator winding is encouraged from an autonomous variable-recurrence variable-voltage inverter. Unwavering quality and greater adaptability to control the resultant torque-speed bend of the engine. In this proposed drive, zero-speed activity is accomplished by autonomously controlling the two arrangements of stator flows, henceforth, keeping up a base electrical recurrence free of the mechanical speed. This component is particularly critical to limit the negative effect of the stator opposition impact at low-speed activity and it incredibly rearranges the execution of speed sensor less control plans. The drive is appropriate for either consistent volts per hertz or field-arranged (FO) activity. Flowing symphonous flows, regular to most double stator machines, are wiped out by the divergent shaft number in every stator winding.

Wind power or wind energy is use of wind stream through wind turbines to give mechanical power to turn electric generators and customarily to do other work, such as handling or tapping. Wind power is a sensible and ecological choice in contrast to consuming non-renewable energy sources, and has an a lot littler effect on the earth. Winds homesteads comprise of numerous individual wind turbines, which are associated with the electric power transmission, organize. Inside wind is a reasonable source of electric power, aggressive with or in many spots less expensive than coal or gas plants Onshore wind cultivates likewise affect scene, as commonly they should be spread over more land than other power stations and should be worked in wild and provincial regions, which can prompt "industrialization of the countryside" and territory loss. Offshore wind is steadier and more grounded than ashore and seaward homesteads have less visual effect, yet development and upkeep expenses are significantly higher. Little coastal wind homesteads can nourish some energy into the matrix or give electric power to detached off-framework areas. Wind power

generation, especially seaward wind power, has been the subject of drastically expanding enthusiasm for ongoing years. Different sorts of arrangement of seaward wind homesteads are required to gather and move the seaward wind power to coastal frameworks with adequate effectiveness and unwavering quality. Wind turbine advancements and power gadgets converters furnish wind power engineers and administrators with the choices important to accomplish wind power transmission targets. In this part, significant setups and highlights of both AC and DC wind generators are delineated. The AC generators incorporate the fixed-speed acceptance generator (FSIG), doubly encouraged enlistment generator (DFIG) and full-power converters for acceptance generators and lasting magnet synchronous generators (PMSG). The DC wind generators spread DC power yield acquired through AC–DC rectifiers and straightforwardly through DC generators.

II. LITERATURE SURVEY

Z. Chen et al. [1] "A review of the state of the art of power electronics for wind turbines" author proposed power electronic uses for wind vitality frameworks. Different wind turbine frameworks with various generators and power electronic converters are depicted, and distinctive specialized highlights are thought about. The electrical topologies of wind ranches with various wind turbines are outlined what's more; the potential employments of intensity electronic converters with wind homesteads are appeared. At long last, the potential strategies for utilizing the power electronic innovation for improving wind turbine execution in control frameworks to meet the primary network association requirements are talked about.

V. Yaramasu et al. [2] "High-power wind energy conversion systems: State-of-the-art and emerging technologies" author proposed far reaching study on the cutting edge and rising breeze vitality advancements from the electrical building point of view. While trying to diminish cost of vitality, increment the breeze vitality change proficiency, unwavering quality, control thickness, and agree to the stringent framework codes, the electric generators and power electronic converters have developed in a thorough way. From the market based review, the best generator-converter designs are tended to alongside few promising topologies accessible in the writing. The consecutive associated converters, latent generator-side converters, converters for multiphase generators, and converters without moderate dc- connect are researched for high-control wind vitality transformation frameworks (WECS), and displayed in low and medium voltage classification. The coastal and seaward wind ranch setups are examined as for the arrangement/parallel association of wind turbine air conditioning/dc yield terminals, and high voltage air conditioning/dc transmission. The deficiency ride through consistence strategies utilized in the acceptance and synchronous generator based WECS are likewise talked about. The past, present and future patterns in megawatt WECS are inspected as far as mechanical and electrical advances, combination to control frameworks, and control hypothesis. The significant study results, and specialized benefits and bad marks of different WECS electrical frameworks are abridged by tables. The rundown of present and future breeze turbines are likewise given along specialized subtleties.

H. Nian et al. [3] "Direct power control of doubly fed induction generator under distorted grid voltage" author proposed direct power control (DPC) technique for a doubly encouraged acceptance generator (DFIG) based breeze control age framework under misshaped lattice voltage. By dissecting the multiple times matrix recurrence control throb created by the fifth and seventh framework voltage consonant parts, a novel DPC procedure with vector corresponding coordinated (VPI) controller has been proposed to actualize the smooth dynamic and responsive power yield of DFIG. The exhibition examination of the proposed DPC system, including the unfaltering and dynamic state execution, shut circle activity solidness, and dismissal capacity for the framework voltage mutilated segment and back EMF pay thing has been researched. The accessibility of the proposed DPC methodology with a VPI controller is checked by analysis aftereffects of DFIG framework under pleasingly mutilated matrix condition.

S. M. Muyeen et al. [4] "Operation and control of HVDC-connected offshore wind farm" author proposed activity and control methodologies of a seaward wind homestead interconnected to a high-voltage dc (HVDC) framework. The seaward wind ranch made out of factor speed wind turbines driving perpetual magnet synchronous generators is considered in this investigation, in light of dc-transport idea. The HVDC transmission framework dependent on a three-level impartial point clipped voltage source converter (VSC) is utilized for the interconnection between the seaward wind ranch and inland network. Nitty gritty displaying and control methodologies are created for the individual part of the general framework. A basic fluffy rationale controller is received in the seaward VSC station, which is one of the notable highlights of this investigation. Genuine wind speed information is utilized in the reproduction concentrate to acquire sensible reaction. Both dynamic and transient investigations of the proposed framework are completed utilizing the research facility standard power framework programming bundle, PSCAD/EMTDC.

A. Egea-Alvarez et al. [5] "Voltage control of multiterminal VSC-HVDC transmission systems for offshore wind

power plants: Design and implementation in a scaled platform" author proposed multiterminal voltage source converter (VSC) HVDC transmission frameworks for the association of seaward wind power plants to the fundamental land air conditioning matrix. A hang based control plan is considered. The hang controllers have been structured base on a blended affectability standard by taking care of an arched enhancement issue with direct lattice disparities. The framework is examined by methods for reenactments and tentatively in a scaled stage. Reproductions demonstrate the control execution during a wind speed change and a voltage list in the principle air conditioning lattice. Exploratory outcomes incorporate wind power changes (increment and decline) and an inevitable VSC misfortune (both considering lattice side and wind ranch VSC misfortune). In every one of the cases, the recreation and the exploratory outcomes have demonstrated a decent framework execution.

S. V. Bozhko, et al. [6] "Control of offshore DFIG-based wind farm grid with line-commutated HVDC connection" author proposed a control answer for mix of huge seaward doubly encouraged enlistment generator based wind ranches with a typical accumulation transport, constrained by a static compensator, into the principle coastal framework, utilizing line-commutated high-voltage direct flow association. The paper's fundamental center is a numerically grounded investigation of the power framework associations. That review created a fitting plant model for formal control structure. A structure method is portrayed and the controlled framework is approved utilizing power frameworks PC supported plan/electromagnetic transient program reproductions, which affirm the elite of the proposed control procedure in both ordinary activity and deficiency conditions.

III. METHOD

A. Dwig Dc Generating System For Wide-Speed-Rang Operation Fig. 1 shows the proposed wide-speed-range-operation DWIG dc generating system. In this generator, a squirrel-cage rotor is used, and two sets of stator windings are properly embedded in the stator slots. One, referred to as the power winding, supplies dc electricity to the loads via the diode rectifiers. The other, called as the control winding, is connected with a voltage-source SEC through the filter inductances to provide variable reactive power to the generator. The power winding is six phase and is set as two three-phase star windings spatially shifted by 30 electrical degrees since this type of winding could

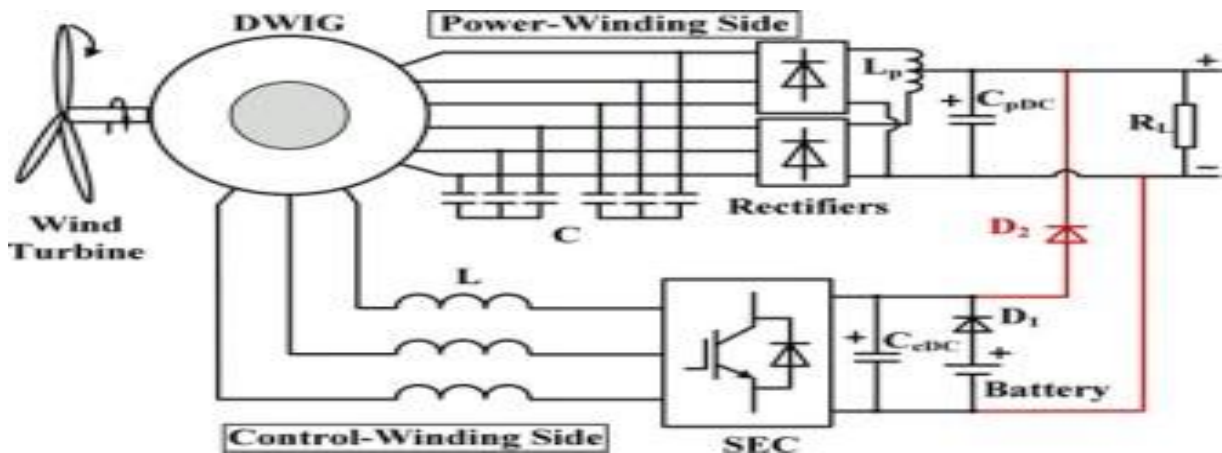


Fig: 1 Proposed wide-speed-range-operation DWIG dc generating system

Effectively reduce the harmonic magneto motive forces induced by the harmonic currents from the diode rectifiers. The control winding consists of a traditional three-phase star winding. The two sets of stator windings have the same poles, so they share the same working frequency. The outputs of the two three phasediode rectifiers are connected in parallel via an interphase reactor. A fixed support excitation capacitor bank is usually linked to power winding to achieve generator excitation together with SEC. If secondary excitation capacitors are properly selected, capacity of control winding can be cheap considerably, and a small-size SEC can be obtained as well. For the success of voltage buildup, a low-voltage and low-power battery is used here to make the SEC provide initial excitation. When dc bus voltage of SEC is greater than battery voltage, battery is automatically detached from system because a diode (D1) is connected in series between battery and dc bus of SEC. In this system, for wide-speed-range process, two dc buses on control- winding side and power-winding side are linked in parallel via a diode (D2). In accord with prime mover speed, this system has two types of working modes, as shown in Fig. 2.

- 1) One is the high-speed-range operating mode [see Fig.2(a)]
- 2) other is low-speed-range operating mode [see Fig. 2(b)]

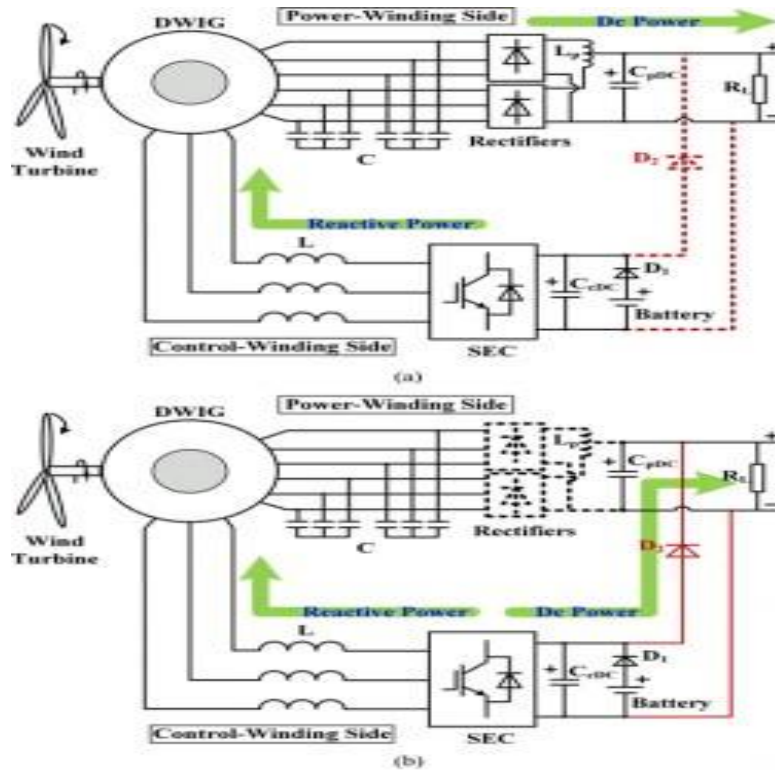


Fig: 2 Two types of operating modes of the wide-speed-range-operation DWIG dc generating system

At high speeds, the output voltage after rectifying can reach the command value. In order to guarantee the system output power is all produced by the power-winding side and avoid complex control strategy, the diode D2 connected between the two sets of dc bus should be off. For this, the dc bus voltage on the power-winding side is controlled to be larger than that on the control-winding side, thus the voltage of the positive pole of the D2 is smaller than that of the negative pole of the D2, and the D2 naturally comes to be off. In this case, the SEC only provides reactive power to the generator, absorbing no active power from the generator if the wire and switching losses are ignored. For Fig. 2(a), the power-winding rectified voltage is namely the system output voltage, and is determined by the power-winding terminal voltage. In the DWIG, two sets of stator windings share the same air-gap flux; thus, the regulation of the power-winding terminal voltage can be implemented by the (a) High-speed-run working mode. (b) Low speed-extend working mode. Guideline of the control-winding motion. In this paper, the CWFO control methodology is utilized. In light of this control technique, the control-winding current can be decoupled, so the control winding transition can be controlled effectively with the assistance of the SEC, in order to guarantee the framework yield voltage steady. At low speeds, because of the attractive immersion, regardless of whether the generator has solid excitation, the yield voltage of the power winding in the wake of correcting still can't arrive at the direction worth, and it would diminish with the lessening of speed. Luckily, in light of the voltage-boosting capacity of the SEC, the dc transport voltage on the control-winding side can arrive at the direction esteem. As the two arrangements of dc transport are associated in parallel through the D2, the voltage of the positive post of the D2 is bigger than that of the negative shaft of the D2, and the D2 normally comes to be on. For this situation, the voltage of the dc transport voltage on the power-winding side is dictated by the voltage of the dc bus.

Voltage on control-winding side. Because input voltage of the diode rectifiers, namely power-winding terminal voltage, is littler than the yield voltage of the diode rectifiers, specifically the voltage of dc transport voltage on the power-winding side, in this manner the diode rectifiers are off, and framework yield power is altogether delivered by switch-winding side. As of now, the SEC gives responsive power to the generator, yet additionally supplies dynamic power by means of the control-winding dc transport to encourage the heap. Along these lines, for this proposed framework, utilizing an appropriate control methodology, it can yield the consistent dc voltage in a wide speed extend, with great and small speeds. This favorable position makes this producing framework extremely fit for the application

fields where the speed of prime mover ordinarily changes in a wide go, for example, wind power frameworks and remain solitary power frameworks. . As appeared in for each wind speed, there is a most extreme power point. Since wind speed is variable and insecure, for wind power frameworks, to catch substantially more wind energy, the most extreme power following procedure is generally utilized, to cause the wind turbine to work in the greatest power bend, in particular. For this, the wind power framework should have the variable-speed activity capacity in a wide speed extend, and the more extensive speed go the wind power framework can work in, the more wind energy can be caught. As indicated by the previously mentioned investigation, applying the proposed DWIG dc creating framework in wind power frameworks, not exclusively can yield the steady dc voltage in a wide speed range, but also can expand the scope of wind energy utilization, especially at low wind speeds. Here speed is control by STATCOM and VOLTAGE CONTROLLER using Boost converter. STATCOM using IGBT works as inverter. Power which we get from Wind is step up by using step up chopper. That power is fed to inverter, inverter convert D.C. into A.C. that AC is given to grid power. By controlling the current and voltage of inverter we control the speed of wind power plant. MPPT is used so that it tack maximum power at various speed.

IV. RESULT AND WAVEFORM

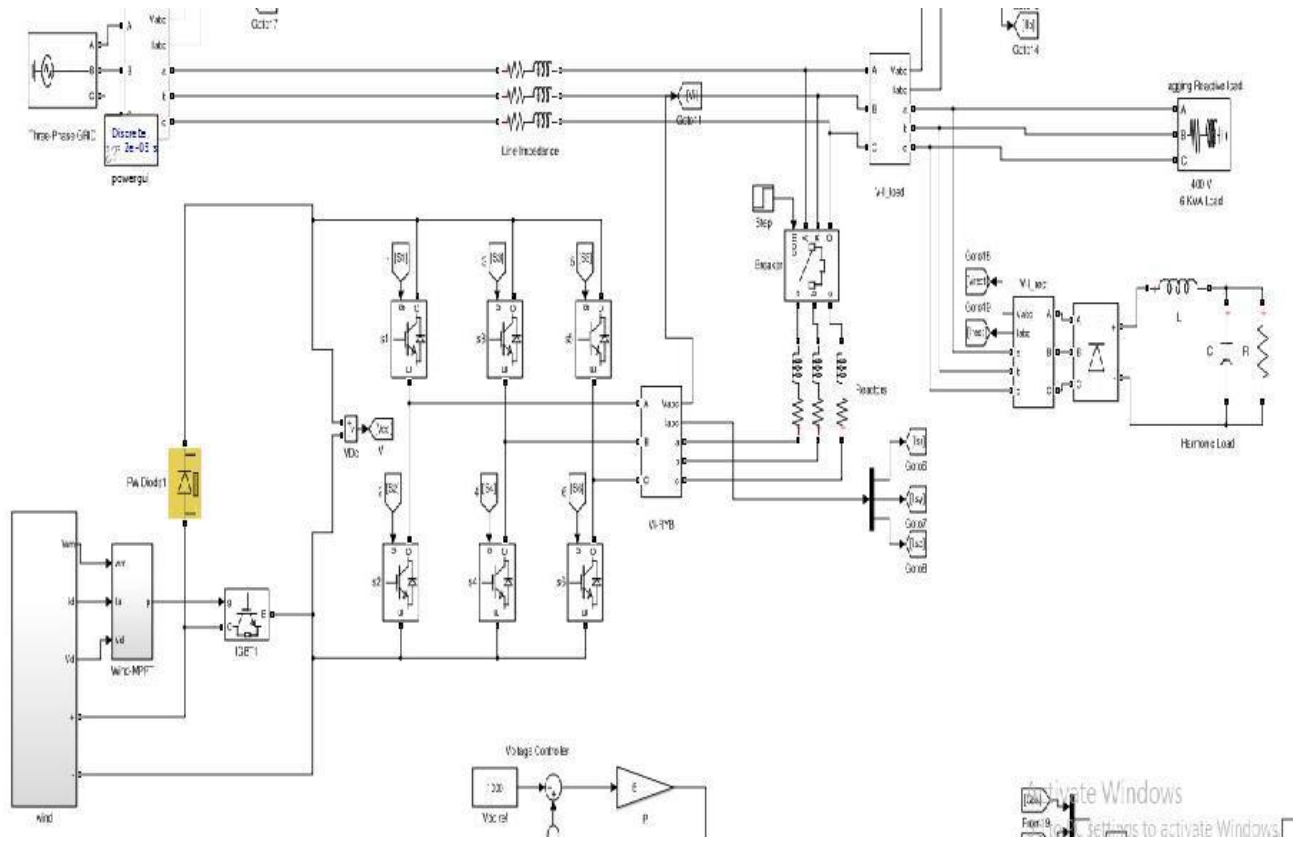


FIG 1- VOLATGE CONTROLLER USING STATCOM

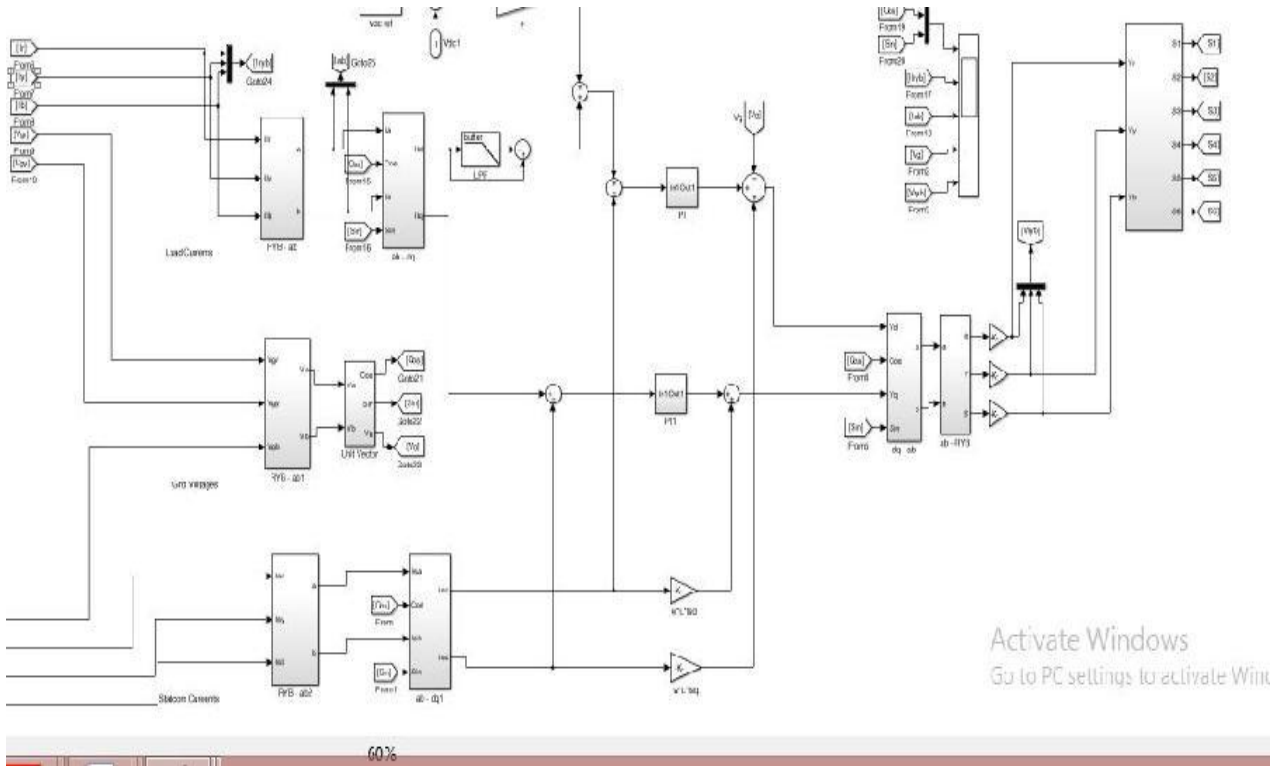


Fig 2 switching of STATCOM

Here figure 1 and figure 2 is proposed block . 1 is initial proposed system and 2 is proposed voltage controller. In proposed model we used wind as a source and it connected with MPPT to track maximum power of wind. After it we are connect with STATCOM to control speed and voltage current variation of the system

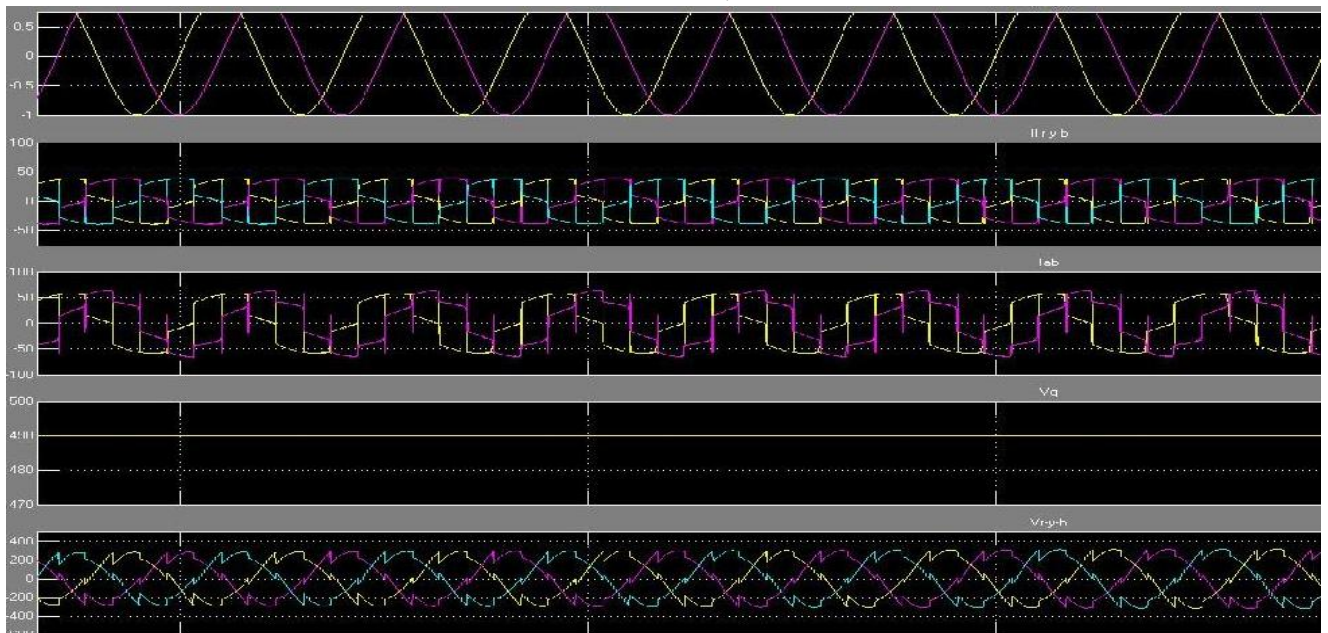


FIG - CONTROLLER RESPONSE

Here is x label show simulation time and y label is variation of controller value Here is x label show simulation time and y label is value of current

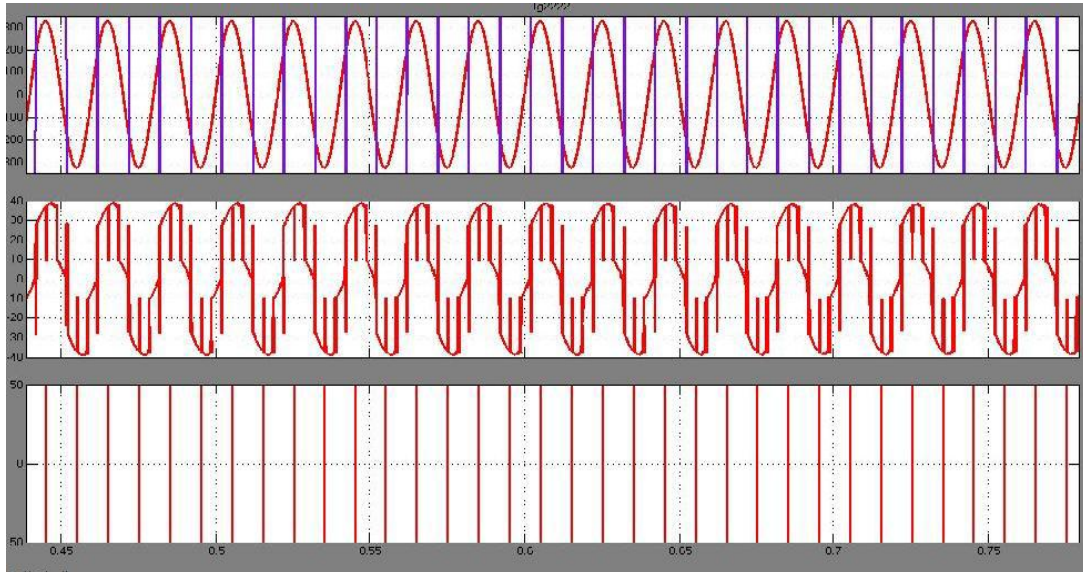


Figure: STATCOM Response

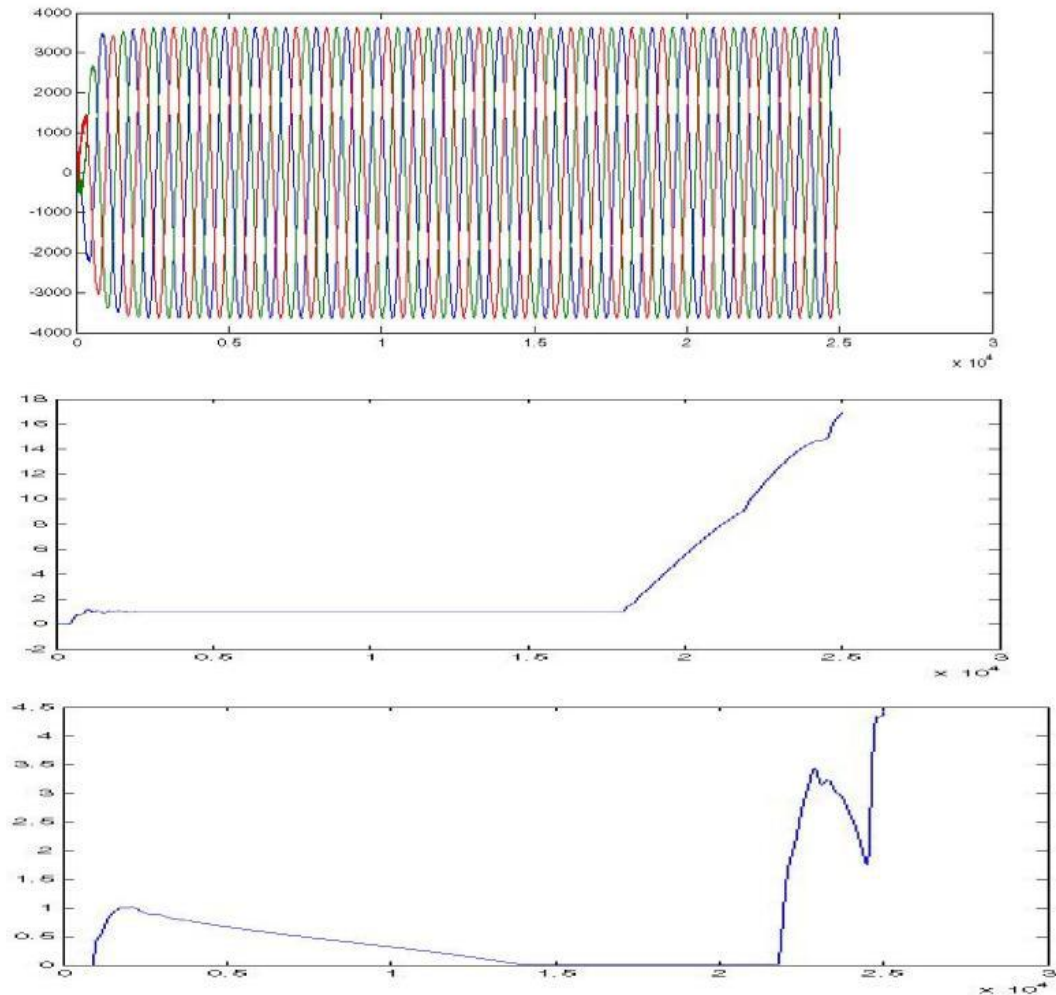


Figure show simulation result when wind is connected with non linear load.

we get content amplitude some initial time. Here is x label is show simulation time and y label is value of output with respect to load

V. CONCLUSION

During this paper studied how to increase the speed of dual stator in wind power system. In this paper there are many survey related dual stator in wind power system. During this work dc generating system for wide speed range operation are studied. STATCOM used as a inverter for reactive power compensation. SEC replace by STATCOM.

All element used are ideal component. Speed control in very smooth way and power quality increase then previous paper.

Total Harmonic Distortion (THD) reduces by step up chopper and STATCOM.

Various waveform of generator current and voltage improve from previous.

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