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A Review of Wind Energy Conversion System with Different Controller and Different Generator-Converter

Ritesh Kumar **[*]** ***and Shriyansh Jain*** **[**]**

**PG Scholar, Department of Electrical Engineering,*
***Assistant Professor, Department of Electrical Engineering,*
Lakshmi Narain College of Technology, Bhopal, (MP)

(Corresponding author Ritesh Kumar)

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ABSTRACT: Wind energy production has been under the main centre for the past decade in energy production and tremendous amount of research work is going on renewable energy, specifically on wind energy taking out. Wind energy provides an environmental energy generation and helps to meet the national energy demand when there is a diminishing trend in terms of non-renewable resources. Wind energy conversion systems have become a focal point in the research of renewable energy sources. This is in no small part due to the rapid advances in the size of wind generators as well as the improvement of energy electronics and their applicability in wind energy extraction. This paper provides a comprehensive review of past and present converter topologies applicable to permanent magnet generators, induction generators, synchronous generators and doubly fed induction generators. The many different generator–converter combinations are compared on the basis of topology, cost, effectiveness, energy utilization and control complexity. The features of each generator–converter design are considered in the context of wind turbine systems.

Keywords: Induction generators; Power electronics; Wind energy, fuzzy logic.

I. INTRODUCTION

Wind energy for electricity production today is a mature, competitive and virtually pollution-free technology widely used in many areas of the world. Wind also still is used to some extent for pumping water. Wind electric systems have some siting problems involving their aesthetics, and some wind machines have problems with killing raptor birds that fly into the blades, though this problem has been minimized with more modern slower-rotating blades and the siting of wind farms outside raptor flying zones. Wind power is the fastest growing energy technology in the world. Total world-wide capacity was 18,000 MW in 2000, about 10% of it in developing countries. India is the world leader with 1,300 MOW of installed capacity. Chine is second with over 350 MW. To estimate the number and rating of the wind turbines necessary to compress 11.2 million kg of air per day, we assume that a wind plant consisting of 1.5 MW wind turbines with characteristics similar to the GE 1.5 MW machine are used to power a central air compressor that compresses air from 1 to 70 atmospheres. Based on the august wind pattern of the Sweetwater Wind Plant alluded to above, approximately 30 wind turbines would be required to compress 11.2 million kg to 70 atmospheres.

Directly coupling smaller air compressors to the shafts of these wind turbines (ie replacing their gearboxes and generators with simplified gearboxes and compressors) would probably result in the same number of wind turbines. The proposed hybrid system has several advantages over separate wind and solar generating facilities. They are:

- a single prime mover – generator and substation
- no need for electric transmission connection to the wind farm (only to the expander-generator),
- wind turbine gear box requirements are greatly simplified (since the speed/torque characteristics of a wind turbine rotor are better matched to an air compressor than a generator),
- no need for natural gas or an industrial waste heat source, and
- no need for cooling water (solar thermal plants typically use steam as working fluid so condenser cooling water is needed).
- Also, since wind energy production in West Texas tends to be higher in winter and spring, and solar is highest in summer months, seasonal fluctuations in energy supply tend to even out when the two sources are combined in an integrated system.

II. REVIEW OF WIND ENERGY SYSTEM

This paper provides sufficient information about the problem of instantaneous replicating in laboratory conditions. The active behaviour of stand-alone low-power wind energy conversion systems (WECS) in reply to the wind speed variations and also to the electrical load variations is simulated. The investigated system consists of a variable-speed wind turbine based on a permanent-mag. synchronous generator (PMSG), a diode bridge rectifier, a DC–DC step-down converter and a broad range DC load. . By imposing either the converter duty ratio or the output current, the second allows the variable-speed command of the turbine rotor. Because of reduced noise level and improved steady-state accuracy, a speed-driven hardware-in-the-loop physical WECS simulator has been used to accomplish this task also WECS model states that the generator torque influences the rotational speed only through the motion equation. So, in the speed-driven simulator structure, there is present a second influence channel by the way of the simulator rotating hardware. Its drawback – i.e, a reduced bandwidth – has been extensively alleviated by using an improved software simulator structure which uses a feed-forward compensation of the inherent physical annoyance produced by the generator torque variations. Both time-domain experimental results and a thorough frequency-domain error analysis show good replication performance in the frequency range of variation of both wind speed and electrical load [1]. This study represents dissimilar power management strategies of a stand-alone hybrid power system which consists of three power generation systems, photovoltaic (PV) panels, a wind turbine and a proton exchange membrane fuel cell (PEMFC). Stand-alone power system depends on the physical and meteorological conditions of the installed region. Therefore, the wind turbine and solar cells may not meet the energy demand. So, a third power supply source might be needed the fuel cell fulfils the need of backup power source. Photovoltaic (PV) and wind turbine is the major supply for the system, and the fuel cell fulfils the need of backup power source. So, permanent energy supply needs energy storing devices. In this anticipated hybrid system, gel batteries are used. PEMFC is an perfect power generation system for such implementations but the cost is high and its casing life span is short. Thus to enhance the operation time of the casing and to enable the permanent energy flow, three power management strategies are anticipated. The planned power management strategies for the hybrid power system assure the load and battery bank SOC. Battery bank's maximum and minimum SOC levels are determining the operation of the fuel cell. The state of charge (SOC), charge-discharge currents are distressed by the battery energy efficiency.

In this study, the battery energy efficiency is evaluated with three different power management strategies. The control algorithm is using MATLAB-SIMULINK [2]. This paper study represents the application of the model predictive control (MPC) approach to control the voltage and frequency of a stand-alone wind generation system. The proposed scheme consists of a wind turbine which drives an induction generator (IG) feeding to a secluded load. A static reactive power compensator (SVAR) is linked at the induction generator terminals to control the load voltage. The rotor speed, and thus the load frequency are controlled via adjusting the mechanical power input using the blade pitch-angle control. The (MPC) is used to calculate the optimal control performance together with system constraints. To get better computational effort and to decrease numerical problems, chiefly in big prediction horizon, an exponentially biased functional model predictive control (FMPC) is working. Digital simulations have been carried out so as to authenticate the efficiency of the planned scheme. The planned controller has been tested from side to side step changes in the wind speed and the load impedance. Simulation results show that sufficient performance of the planned wind energy scheme has been achieved. Moreover, this scheme is healthy against the parameters variation and eliminates the influence of modelling and measurement errors [3]. This paper represents a technical analysis of system transient behavior and a small-signal analysis of DFIG. With increasing wind power saturation, transient responses of doubly-fed-induction-generator (DFIG) based wind turbines requires a great awareness. Exact statement of transient response of DFIG under grid faults is required with growing wind power utilization. Also the influence of main flux saturation on overall peak currents in DFIG under grid fault is limited. Thus, the magnetizing inductance can be taken as steady when designing ride-through controllers and protection systems. So that the main flux saturation and deep-bar effect, this paper concentrates on transient responses and stability of the DFIG system alongside symmetrical grid faults. Their roles played in the enhancement of system transient stability are stated. The given analysis contributes advantageously to proper selection, design and coordination of protection devices and control strategies as well as stability studies [4].

In this paper a wind-turbine with furling mechanism and its consequential dynamics are modeled using MATLAB/SIMULINK plot. It analyses the regulation of the speed of the wind-turbine via a load-control method. Tip-speed ratio and hill-climbing are control methods for maximum-power extraction from a small wind-turbine as evaluated. Two dynamic controllers are designed and their behaviors simulated.

In the first method, the controller use the wind-speed and rotor speed information to manage the load so as to operate the wind-turbine at its optimal tip-speed ratio. In the second method, the controller compares the output power of the turbine by the previous power, and controls the load based lying on the power difference. With the aim to determine a suitable control strategy in favor of the small wind-energy conversion system, several tests are performed. Wind-speed versus power-curve and annual energy capture of the system for every control method are determined for wind conditions. The annual energy-capture is determined using the bin's power-curve method. The results of the simulations indicate that the energy capture of a wind-turbine depends not only on the control strategy except on the wind-speed and Rayleigh distribution. The results of the study lead to the conclusion that the hill-climbing method of control results in a better annual energy-output [5].Hybrid power production units seem to be an interesting alternative for supplying isolated sites. This study proposes a new supervision strategy in order to ensure an optimized energy management of the hybrid system. The considered hybrid unit includes a wind generator (WG), a fuel cell (FC), an electrolyzer (EL) and a super capacitor (SC). As in general power management approach was designed as to assurance of the power flow management between the energy sources and the storage elements. The aim of this study was to develop an energy management algorithm with respect to wind speed fluctuations, load power variations, slow dynamics of the hydrogen system and SOC of the SC. The fast response of the planned control strategy allows an optimized energy management of all elements of the hybrid unit and ensures a high quality energy supply with a permanent feeding of the three-phase load. A mathematical analysis of the hybrid system using models implemented in MATLAB/SIMULINK software was developed. Simulation results demonstrate the performance of the control strategy for an optimal management of the hybrid power production unit under different scenarios of power generation and load demand with the value of the considered hybrid unit arrangement and to prove the dependability of the developed supervision algorithm. [6]. This paper explains the steady state and dynamic models and control strategies of wind turbine generators. The models are presented in the d-q frame of reference. Different control strategies in the generator side converter and in the grid side converter for fault be carried through requirement and active power/frequency and reactive/voltage control are presented for variable speed wind turbines. The increase of wind energy integration is therefore a concern particularly to transmission grid operators.

There are still a number of wind turbines based on fixed speed induction generators (FSIG) currently running, majority of wind turbines that are planned to be erected are of variable speed configurations. The reason for this is that FSIG are not capable of addressing the concern mentioned above. Thus, existing researches in wind turbines are now widely directed into variable speed configurations. The modelling of wind turbine generators was described. The simulation of FSIG shows its failure to withstand network fault. Alternatively fully rate converter wind turbines (FCWT) based on an induction generator was described with the generator side controller based on rotor flux oriented control and the generator side controller was based on magnitude control and load angle. A step change in mechanical input torque was used to measure the performance of the generator side controller through a change in wind speed. It was depicted that the inertia of the wind turbine is an important factor in the dynamic behaviour of the wind turbine, because a large inertia reduces the changes in the mechanical speed for normal variations in wind speed. Variable wind turbines are doubly fed induction generator wind turbines and full converters wind turbines which are based on synchronous or induction generators [7]. This paper presents an alternative control strategy of a stand-alone self-excited induction generator (SEIG) driven by a variable speed wind turbine. The planned system consists of a three phase squirrel-cage induction machine coupled to a wind turbine through a step-up gear box. A current controlled voltage source inverter (CC-VSI) with an electronic load controller (ELC) is connected in parallel with the main consumer load to the AC terminals of the induction machine. The proposed control strategy is based on fuzzy logic control principles which enhance the dynamic performance of the proposed system. Three fuzzy logic PI controllers and one hysteresis current controller (HCC) are used to extract the maximum available energy from the wind turbine as well as to regulate the generator terminal voltage simultaneously against wind speed and main load variations. However, in order to extract the maximum available energy from the turbine over a wide range of wind speeds, the captured energy is limited due to electrical constraints. Therefore the control strategy proposed three modes of control operation. The steady state characteristics of the proposed system are obtained and examined in order to design the required control parameters. The proposed system is modelled and simulated using MATLAB/SIMULINK software program to examine the dynamic characteristics of the system with proposed control strategy. Dynamic simulation results demonstrate the effectiveness of the proposed control strategy [8]. The use of multilevel converters has increased tremendously owing to their merrits in high-voltage and high-power applications. Balancing the DC capacitor in the neutral-point clamped (NPC) topology is a main factor of concern in these converters. The DC voltage must be fixed at its reference value to avoid overvoltage stresses on the semiconductor and to overcome modulation distortion.

This paper presents a new method of regulating the DC voltage of a back-to-back NPC five-level converter used in a wind energy conversion system based on doubly fed induction generator. The proposed control algorithms has two loops: the outer closed loop which controls the average value of the DC voltage, whereas the inner loop that controls the difference between two voltages in each half-arm with a clamping bridge circuit. To verify the validity of the method and to prove the performance of the proposed control algorithms, simulation was carried out in a MATLAB/SIMULINK environment. The results obtained show the effectiveness of the proposed algorithms. The converter cascade was applied in a wind energy conversion system to control the active and reactive power delivered to the grid using DFIG. The proposed control algorithm incorporated the control in closed loop of the average DC voltage and the control algorithm of the proposed clamping bridge. The advantage of this method is that it uses a passive circuit with a simple control algorithm that facilitates its implementation. Modelling the different components of the studied system has been presented. The simulation results confirmed the efficiency and accuracy of the control algorithm to improve the DC voltage. The proposed scheme is extended and thus applied to high-power systems [9]. This paper represents a numerical evaluation of the smart load control on an Upwind/NREL 5 MW reference wind turbine under the IEC extreme wind shear (EWS) condition utilizing the newly developed aero-servo-elastic platform. The control action was implemented through the local perturbation of a deformable trailing edge flap (DTEF) per blade, which was driven by a smart rotor system, based on the FAST/Aerodyn and MATLAB/SIMULINK codes. Results when compared with the original collective pitch control method, the aerodynamic load in terms of blade flap wise root moment and tip deflection were effectively reduced. Furthermore, the smart rotor control also positively affected other components of the drive-chain as well as generator power and pitch system. It was found that the smart control effect altered the nature of the flow-blade interactions and modified the in-phased fluid-structure synchronization into much weaker couplings.

As a result, the damping of the fluid-blade system was enhanced, thus causing great attenuation in the EWS load on both rotor and other drive-chain components. In this research presently developed DTEF based smart control effectively turns the strong synchronized flow-blade interaction due to EWS turbulence into a much weaker one. This is associated with increase in the effective damping ratio of the flow-blade system, implying an enhanced dissipation of flow and blade vibration energies and their diminished correlation.

As a result, the rotor extreme load at the dominant 1P mode and subsequent those on drive-chain components are outstandingly reduced [10]. The proposed wind energy conversion system with battery energy storage is accustomed to exchange the controllable real and reactive power in the grid. The system has an interface of inverter in current controlled mode for switch over of real and reactive power support to non-linear load. The proposal utilizes power electronic switching device approach. The generated wind power can be extracted in varying wind speed and can be stored in the batteries at low power demand hours. In this system, inverter control is executed with hysteresis current control mode to attain the faster dynamic change over for the support of grid. The combinations of battery storage with wind energy generation system, which will synthesizes the output waveform by injecting or absorbing reactive power and allow the real power flow required by the load. The battery energy storage provides fast response and enhances the performance under the variation of wind turbine output and improves the voltage stability of the scheme. This system is providing a option to select the most cost-effective real power for the load between the available wind–battery-conventional resources. The system reduces the burden on the conventional source and utilizes WEGS and battery storage power under load constraints. The system provides quick response to support the grid. The scheme can also be operated as a stand-alone system in case of grid failure like a continuous power supply. The system is simulated in MATLAB [11].

This paper shows the combination of wind energy conversion system (WECS) with photovoltaic (PV) & solar farm (SF) which acts as flexible ac transmission system controller-static compensator (STATCOM) through night time, to control the point of common coupling voltage and to correct faults when SF is not producing any active power. The planned control will enable improved connections of WECS. The planned scheme of PV SF control will smooth the progress of integration of extra wind plants in the arrangement without needing supplementary voltage-regulating devices.

PV Solar farm nearly inactive during night time in terms of active power generation is accustomed to regulate the distribution voltage at PCC inside utility specified limits even through wide variations in WF output and rectifies the fault. This narrative strategy implies operating PV solar plant as a generator through the day [providing megawatts (MW)] and auxiliary services sources at night [providing mega volt amperes (MVARs)]. MATLAB/SIMULINK based simulation results are obtained for validation of the system [12].

This paper proposes a grid-connected wind energy conversion system (WECS) connected to PWM multilevel current source inverter (MCSI) topology. The topology is originated from the multilevel voltage-source inverter (MVSI) by dual conversion; comparatively low line current harmonics at the grid, which is equivalent to that of line-line voltage for 5-level VSI. The topologies are abounding with two independent DC current-sources, 2n+1 current levels are obtained at the output. In the planned control method, for direct-driven wind energy conversion system applications, the dc-link current can be adjusted according to the variation of wind speed through phase-control thyristor rectifier. At the grid side, control scheme of independent active and reactive power control was developed. Based on grid voltage oriented control, q-axis factor of grid voltage is keeping up to zero though PLL, therefore the active and reactive power can be separately controlled by regulating the d-q reference currents. According to the needs of power balance control, the leading, unity, or lagging displacement power factor is produced. DC-link current controller is used to regulate and stabilize dc link current, output power factor controller is used to separately control the real power or reactive power, and unity power factor is easily attained at grid side. Validation of models, control, steady-state and transient performances of a WECS based on 5-level CSI is carried out in the MATLAB/SIMULINK environment [13]. This work is aiming to improve performance of a wind energy conversion systems (WECS), derived from double fed induction generator (DFIG), and take out power over wide range of speed variation. Indeed, the power of DFIG by two indirect converters associated with the principle of power distribution can operate the system conversion in a wide range of speed variation. The DFIG feed arrangement is an low-cost solution because the machine is not a consumer of reactive power, but it can provides us, and it is electrically decoupled with electric network, so the instability of the latter do not affect the DFIG. Increasing the power density allows to decrease the dimension of the whole of WECS and therefore the cost of the installation is reduced. The system is decoupled with electrical network, so the disturbances of the latter do not affect the DFIG. After modeling different parts of WECS, we proceed to the system control using MPPT with optimal operating point (OOP) method. Simulation work is carried out on the software MATLAB/SIMULINK and the results confirm the validity and reliability of the power structure and the control strategy used [14]. The study of a Wind Energy Conversion System (WECS) based on Permanent Magnet Synchronous Generator and interconnected to the electric network is described. A 2 MW PMSG variable speed wind power generation system is simulated to show the proposed control strategy through the grid fault. The control strategy can apply the theory of MPPT to regulate WTG velocity according to instantaneous wind speed. Moreover, control strategy based on Vector Control (VC) theory is applied for generator converter and for inverter. As the speed of WTG differ along the wind velocity variation, the rectifier is used to track the maximum wind power, although the inverter can send the energy from the PMSG to the electric grid at unity power factor. Besides, Direct Power Control (DPC) of three phases PWM inverter is adopted and Grid-side reactive and active power decoupling method is applied. The employed control strategy can regulate both the reactive and active power separately. The performance of system has been recognized under varying wind conditions and the grid fault conditions. Consequently, WECS can not only capture the maximum wind energy, however it can also sustain the frequency and amplitude of the output voltage. Simulation results have shown the effectiveness of the proposed control strategy for WECS based on the PMSG [15]. By introducing the regulation of nervous-endocrine-immune net into the study of wind-power yaw control system, and designing an artificial intelligent yaw controller based on the nervous-endocrine-immune regulatory mechanism of the organism. The controller received the ecological information by non-natural immune system and to make the suitable yaw control. Here we design the non-natural structure of neuro-endocrine-immune yaw control in which yaw controller is composed of wind direction recognition unit, wind variation present unit, wind variation processing unit, control unit and optimization unit. Also it references biology neuro-endocrine immune adjustment control method, and analyzes the characteristics of adaptive control organisms, studies the yaw control of adaptive learning algorithm under the circumstances of the changeable wind speed, wind direction and other natural factors, improve the stability and robustness of the yaw system which puts the “wind bias present unit” and “wind bias processing units” similar to the organism the immune system, the “organisms master unit ” equivalent to biology endocrine system, and the " optimization unit “equivalent to biology nervous system. Artificial immune network applied to neuro-endocrine wind turbine yaw control system. The modification can be inherited through genetic algorithm to ensure that the yaw system of self-learning and adaptive ability. Efficiency of the system was verified on a wind turbine mode using MATLAB.

Compares with the fuzzy PID and the traditional PID, results illustrate that the controller has more capable in terms of the stability and robustness [16]. In this study, an adaptive neuro-fuzzy inference system (ANFIS) is proposed to forecast wind power generation. In this model, an artificial neural network is in work to develop the fuzzy expert system so as to achieve a more practical valuation of wind power extraction. A small scale vertical axis wind turbine is used to simulate the performance of the developed model. Also, demonstration has been performed to look into the effect of ANFIS model on the system performance of the wind turbine and its power extraction. The power generation by wind velocity is a complex development with many interacting factors such as wind velocity, climate condition, natural disaster, control system, design structure, vane tip speed ratio, centrifugal force, rotor drag, turbulence flow, roughness and wind shear, etc. Various actions have been reported in literature to achieve an optimal performance and system usefulness. However, these control methods had depended only on exact mathematical modelling or on expert's knowledge that can't be relied on solely in modelling such a complex management of air flow mechanics due to its unstable climate condition and so on. This work has verified the viability of the developed ANFIS model to estimate power genertaion in wind turbine within high accuracy without needing to go through laborious experimental work for a variety of environmental situation with many uncertainties which can be non economical and time consuming [17]. This paper presents wide-ranging modeling of direct-driven PMSG-based grid-connected wind turbines which is one of the gifted technologies in wind power generation schemes along with the control schemes of the interfacing converters. In this arrangement, two different control schemes are designed for the generator and grid side converters. Under dissimilar wind speed conditions, MPPT is provided via the developed control system of the generator side converter, while decoupled active and reactive power control is investigated by the means of the grid side converter control. A voltage regulation loop is implanted in the control scheme of the grid-side converter to reduce flicker emission. It comprehensive models of wind turbine are accustomed to analyze power and voltage fluctuations. The short time flicker index is used to consider the voltage fluctuation emitted. The effects of grid and site parameters on voltage fluctuation are investigated. Simulation results show that reduced flicker emissions are given when the developed voltage regulation loop is activated. Reasonable values of grid and site parameters contribute in the minimization of voltage fluctuation and flicker emission levels. MATLAB/SIMULINK environment is conducted to examine the performance of the system [18].

Grid synchronization is a basic matter in the link of renewable energies to the grid by using power converters. This paper presents an study and comparison of Phase Locked Loop (PLL) strategies for the synchronization to the grid of a wind energy conversion system (WECS) based on a permanent magnet synchronous generator (PMSG). It discusses the impact of PLL into the output current of three-phase inverter, during an analysis of the harmonic distortion contained in the current for each case. A comparison between three different Phase Locked Loop (PLL) strategies for the synchronization to the grid of a wind energy conversion system based on a permanent magnet synchronous generator (PMSG) has been carried out. Also, noted that the planned PID control improves the overshoot present in the case of used cascaded lead compensators. From study of harmonic distortion, the PLL1 introduces a lower total harmonic distortion when implemented in the generation system, because does not present transient performance but has no control over the d-axis voltage The simulation results obtained by MATLAB/SIMULINK shown that the PLL planned in this work, presents a acceptable performance in steady state and transient study [19]. In this paper, a fresh model of the squirrel-cage SEIG is developed to simulate both the rotor and stator faults taking iron losses, main flux and cross flux saturation into explanation. With the purpose of control the speed of the wind turbine, while basing on the linear model of wind turbine system about a particular operating point, a new Fractional-Order Controller (FOC) with a simple and practical design method is proposed. The FOC ensures the stability of the nonlinear system in both vigorous and faulty conditions. Furthermore, so as to detect the stator and rotor faults in the squirrel-cage self-excited induction generator, an on-line fault diagnostic method based on the spectral analysis of stator currents of the squirrel-cage SEIG by a Fast Fourier Transform (FFT) algorithm is used. It aims at detecting and diagnosing fault type (stator unbalance or/and bar broken) of the SEIG in wind turbine system. A fractional-order PIDD controller with a realistic and simple design scheme is proposed to control the wind turbine speed in vigorous and faulty conditions. Furthermore, a comprehensive model of the squirrel-cage SEIG is developed to simulate both the rotor and stator faults taking iron loss, main flux and cross flux saturation into account. Simulation results show that the closed-loop wind turbine system can attain favourable dynamic performance and robustness. This control scheme can be also used for different wind turbine systems that use the blade-pitch angle control.

The simulation results obtainable in this paper validate the planned model, the chosen analytical method and the planned control scheme [20]. Two fresh direct active and reactive power control strategies for a DFIG-based wind energy conversion system, based on the (fuzzy logic controller) FLC are planned in this paper: the FDPC and the FFDPC. Originally, the mathematical model of the DFIG in the synchronous reference frame is derived. Then, based on this model, two new FLC-based DPC strategies, called (fuzzy-based DPC) FDPC and (fully fuzzy-based DPC) FFDPC are anticipated. The FFDPC directly calculates the rotor reference voltages from the instantaneous power errors using an FLC, while in the FDPC, proper feed forward terms are additional to the FLC outputs to advance the dynamic performance. In the FDPC, the necessary rotor voltages to remove power errors contained by each set sampling period are directly calculated based on the FLC, the calculated active and reactive powers, the stator voltage and several machine parameters. On the other hand, in the FFDPC, the rotor voltages are directly designed from the FLC. The control structures of planned methods are easy and also these methods are based on stator voltage orientation relatively than stator flux orientation. The harmonic filter and the converter design is simple because of the stable switching frequency. The converter switching frequency is steady which simplifies the practical operation. Also the proposed methods are robust next to machine parameters mismatches and grid voltage instability. Simulation results confirm the usefulness of the planned methods under transient and steady state circumstances. Also, the simulated presentation of both methods under harmonically distorted and unnecessary grid voltages show that they can fruitfully maintain their normal operation, with just improved power ripples which are clearer for the FDPC [21].

III. CONCLUSION

This paper reviewed and discussed the available different controller for wind energy systems. analyze simulation and comparison of three selected control methods in terms of efficiency and speed of response. paper provides a comprehensive review of past and present converter topologies applicable to permanent magnet generators, induction generators, synchronous generators and doubly fed induction generators. The many different generator–converter combinations are compared on the basis of topology, cost, effectiveness, energy utilization and control complexity. The features of each generator–converter design are considered in the context of wind turbine systems The detailed results has been noted and analyzed in chapter 5 with proper justification. In view of that, future scope aims to Develop a controller, which can effectively improve the dynamic stability, transient response of the system during faulty grid conditions. Wind 3energy system with fuzzy logic controller based system design.

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