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A Review on Diminution of Power Quality Issues in a Microgrid Using Various Facts Devices

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ABSTRACT
Renewable Energy Sources see opportunities in fulfilling rising demand with excellent power quality and dependability. As a result, the notion of micro-grid has emerged, with ubiquitous power providing generation units known as distribution generation units. A Microgrid can operate autonomously or with public grid connectivity. In the distributed power system, power quality problems start when the number of nonlinear loads and power-electronic distribution generation systems grows. This study conducts a few researches to improve power quality concerns utilizing FACTS devices.

Keywords- Electromagnetic interference, Flexible AC transmission system controllers, Microgrid, Power quality issues, Renewable Energy Sources,

INTRODUCTION

Power quality problems include brief disturbances in the form of transients, voltage dips and spikes, harmonic distortion, and flickering lights. The aim of designing electrical power grid is to deliver and maximize availability of reliable power for the customers [1-4]. Voltage transients, occurrence of harmonics from resonance and power semiconductor devices, Electromagnetic Interference, Communication failures, Inrush and circulating currents, faults such as voltage unbalance in bipolar DC bus are considered to be the most occurring power quality problems in a micro-grid. All these non-linear loads result in voltage distortion. Distributed Generation (DG) units not only provide clean power to critical loads without any distortions originating in the grid but also affirm energy supply to critical loads during continued disruptions as backup device [5-11]. The disturbances originated from the grid can be isolated from the loads using proper interface devices such as Flexible A.C Transmission System (FACTS) devices [12-15]. The FACTS technology incorporates power electronic controlled storage devices installed on the transmission side improvising power transfer capability and maintaining power flow over designated routes [14].

MITIGATION OF POWER QUALITY ISSUES USING FACTS DEVICES

The grid stability is crucial due to alternative usage of conventional power generation sources and there by these FACTS devices perform a vital role [7-9]. The following Fig. 1 shows FACTS controllers classification.

Performance Analysis of Distributed Power Flow Controller Employing Genetic-Based Fuzzy Logic Controller in Photovoltaic-Wind Hybrid System

V. Sowmya Sree and C. Srinivasa Rao

Abstract The deployment of hybrid non-conventional energy sources has become inevitable due to decrease in natural resources, global warming, growing energy costs, and expanding electrical consumption are all factors to consider. Because solar and wind energy are both free and environmentally beneficial, they are regarded as the finest options for remote (or rural) electricity. The combination of solar power and wind power is a reliable source of energy creating a constant energy flow by avoiding the fluctuations. But this hybrid system gives rise to complications related to power system stability. Most of the industrial loads are controlled by power electronic converters that are sensitive to power system disturbances. Hence, the power quality issues diminution is more focused in recent times as it is vital in power supply industry. A number of FACTS devices such as power semiconductor devices are developed to overcome the above power quality issues. Distributed power flow controller (DPFC), which is emerged from unified power flow controller, is considered as the best reliable device among the others. The DC link is the key distinction between these devices. In the case of DPFC, the DC connection that links both converters does not exist. This paper presents the performance analysis of DPFC when operating with and without genetic algorithm-based fuzzy logic controller, and the simulation results are validated using MATLAB/Simulink software.

Keywords Distributed power flow controller (DPFC) · Fuzzy logic controller (FLC) · Genetic fuzzy logic controller (GFLC) · Power quality · Solar and wind system

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Mitigation of Power Quality Issues in Hybrid Solar-Wind Energy System using Distributed Power Flow Controller

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***Abstract*— Renewable Energy Sources find a scope for the prospects in meeting the growing demand with high power quality and reliability. This has led to the concept of Micro-grid with widespread power supplying generation units called distribution generation units. The operation of a Micro-grid can be autonomous or with public grid interconnection. The combination of solar power and wind power is a reliable source of energy creating a constant energy flow by avoiding the fluctuations. The increase in penetration of non-linear loads and power-electronic incorporated distribution generation system initiates power quality disputes in the distributed power system. Hence, the mitigation of power quality issues is more fixated and few investigations led to the use of FACTS devices such as custom power semiconductor devices for this purpose. Distributed Power Flow Controller, which is emerged from Unified Power Flow Controller, is considered as the most reliable device among all the devices. The main difference between these devices is the absence of DC-link in Distributed Power Flow Controller. This paper presents the enactment of Solar-wind hybrid system without custom power device and with Distributed Power Flow Controller. The simulation results are validated using MATLAB/SIMULINK software.**

Keywords*— Distributed Power Flow Controller (DPFC), Power quality, Solar and Wind System.

I. INTRODUCTION

Now-a-days the renewable energy-based power systems play a major role replacing the conventional sources-based power systems. The main advantage of renewable energy sources is that they are environment-friendly and do not produce any greenhouse gases during generation of electricity. Solar energy and wind energy are considered as rapid developing sources globally. The solar power depends on the solar irradiance and wind power depends on wind speed instantly. But the photovoltaic and wind energy sources create frequency and voltage oscillations in power system due to its intermittent nature [1-3]. Therefore, the renewable energy sources inject a fluctuating power into the grid.

Power quality is the major problem faced by an integrated microgrid system [4]. The different types of power quality issues in a micro grid are caused by sudden changes in load, under voltage load shedding, sudden loss of resource, faults at load side and during islanding. The major source of poor power quality in the network is voltage unbalance [5-6]. The use of FACTS controllers is considered to be the best solution for power system stability problems especially steady-state control. The expansion of FACTS devices started with increasing capabilities of power electronic components [7]. Fig.1 shows the classification of FACTS controllers.

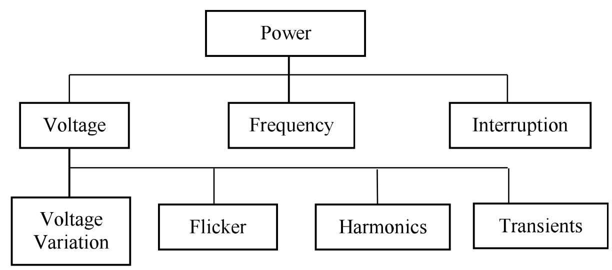

Fig. 1 Classification of Power Quality Issues

In this paper, the authors proposed a novel device called Distributed Power Flow Controller (DPFC), which is an advanced version of Unified Power Flow Controller for improving the operation of power system network [8]. The absence of DC link between the converters is the major difference between DPFC and UPFC. In DPFC, the third frequency harmonic component acts as link between both converters for dynamic power trading [9].

In view of the above, the proposed dynamic system is presented in section-2. The detailed analysis of Simulation results is presented in Section-3. while the conclusions of the work are presented in Section-4.

II. PROPOSED DYNAMIC SYSTEM

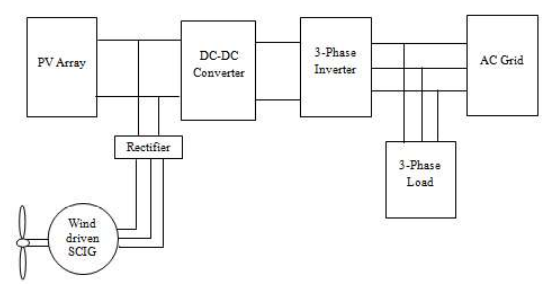

Fig. 2 Block Diagram of Photovoltaic-Wind Hybrid System

The block diagram of hybrid energy system comprising of solar PV array and wind system is shown in Fig.2. Whenever fault occurs at Point of Common Coupling (PCC), it reflects on output power as well as grid power. Therefore, a custom device named DPFC is used to enhance the power quality issues appeared at the load. In this paper in order to control the converters of DPFC Fuzzy Logic Controller and Genetic Based Fuzzy Logic Controllers are used.

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Distributed power flow controller based on fuzzy-logic controller for solar-wind energy hybrid system

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ABSTRACT

The demand of electricity globally led to the concept of renewable energy resources for power generation that are eco-friendly and freely available from nature. The solar photovoltaic systems and wind-based power generators are considered as primary renewable resources and are called as Distributed Generation units as they are scattered in nature. These are operated with bidirectional converters by providing auxiliary services at grid side and load side in either mode of microgrid operation. Besides, the DC power generation units' integration gets converted into AC system by means of inverters. These types of systems not only increase voltage and current harmonics, power frequency deviations but also drive the distribution system to risky operating zone. This emphasizes the stipulation of advanced control schemes for microgrid architecture. Consequently, power electronic converters introduce harmonics in the system and affect the system performance. To report these expanded issues, the authors recognized an advanced custom power device entitled distributed power flow controller. The proposed hybrid solar-wind energy system is first studied with a distributed power-flow controller. Later the system is examined by replacing proportional integral controller with fuzzy logic controller (FLC) for shunt control of distributed power-flow controller. To validate the investigations, MATLAB/Simulink software is used.

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1. INTRODUCTION

The swift escalation of power electronic equipment and its appliance have vividly altered the distinctiveness in the distribution system. The redundant serious power-quality problems are created in recent distribution system due to power electronic device based nonlinear components. Fascinatingly, it is renowned that the same power electronic devices have the capability to shield utility grid and load either from power quality problems. The flexible AC transmission system (FACTS) device and custom power device (CPD) are considered as the vital compensation devices to be installed in power system for finest control of active and reactive power flow [1]. The development of the FACTS has allowed for the implementation of various novel ideas that are making the power system more dependable, flexible, and providing greater control over power flow without affecting the generating schedule.

In an effort to optimize the performance of the power system network, the authors of this research suggest an unique device termed as distributed-power flow controller (DPFC), which is an improved version of the unified power flow controller (UPFC). The primary distinction between DPFC and UPFC is the lack of

Research Article

Mallu Rama Prasad Reddy*, Subramanya Sarma Saraswathula, Vangala Naga Siva Rama Murthy, and Challagulla Kesava Tripureswari Sita Raghava Kowstubha

Control strategy for plug-in electric vehicles with a combination of battery and supercapacitors

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Abstract: Research proposes an optimal power distribution approach for application of electric vehicle (EV) with use of hybrid energy storage system (HESS). HESS protection structure includes dual isolated-based soft-switching symmetrical coupling with half-bridge bidirectional converters to the system of battery and supercapacitors (SCs). The bidirectional converter properly controls the charging process of the battery and SC as well. Besides, spiral wound SCs of mesoporous electrode material have been used in EVs. In the drive cycle of EVs, the operation of SC relates to the functionality of the allocated scheme under "peak load transfer" at $2i_{sc} \sim 3i_{bat}$ current profile carried out. New energy allocation strategies under SOC control enable SC charging and discharging at peak currents of around $4i_{bat}$. The comparison of the mode of the battery system showed that the performance acceleration built under EVs has been improvised at a certain rate of 50% with a loss of energy minimised to 69%. As a result, the technique adapts different load curves, thus enhancing the utilisation of energy with reduced aging of the battery. The simulation results show that the proposed scheme meets the power demand of a typical driving cycle, for testing vehicle performance, and various energy management system have been assessed based on hydrogen consumption, overall efficiency, state of charge of SCs and batteries, stress on hybrid sources, and DC bus stability. The proposed strategy reduces hydrogen consumption by 8.7% compared to other strategies.

Keywords: energy allocation, battery life, plug-in electric vehicle, HESS, battery, controller, supercapacitor

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1 Introduction

Energy scarcity and environmental degradation have recently gained prominence [1–6]. Increasing car ownership has increased pollution from automobile exhaust emissions, prompting the automotive industry to accelerate energy transformation. Electric vehicles (EVs) are a new mode of transportation that saves energy, reduces emissions, and reduces reliance on fossil fuels.

The EV's power supply system directly affects the vehicle's overall performance [7–9] and is currently a key impediment to EV development [10]. EVs require greater particular energy, increased energy density, and specific power, low self-discharge, greater life cycle energy storage systems (ESSs), along with better efficiency under charging case [11–15].

Traditional EV ESSs use batteries, which have many flaws and limits. First, the battery's power density is low; thus, it cannot fulfil EVs' peak power demands during acceleration or climbing. While increasing the quantity of battery cells can meet the power need, the EV load will climb significantly. Second, frequent current shifts cause heat, limiting efficiency and battery life. So, we investigate hybrid energy storage systems (HESS) with batteries and supercapacitors (SCs).

Starting, acceleration, deceleration, stopping, and rising all necessitate a wide range of power. In this case, SC-to-battery system voltage regulation is difficult to execute. In the study, a bidirectional DC/DC converter connects with SC toward the battery system. Low battery current improves discharge persistence. Full driving cycle usage reduces power loss under load curves. Discrete optimisation improves EV control. We improve the architecture and provide a power allocation method based on current EV control to accurately predict future power needs. Current control with SOC management of SCs based on EV driving speed reduces battery overcharging/discharging, improves EV mountaineering performance, increases energy utilisation rate, and reduces battery ageing. HESS structures have dual energy storage and one load mechanism.

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ABSTRACT
Renewable Energy Sources see opportunities in fulfilling rising demand with excellent power quality and dependability. As a result, the notion of micro-grid has emerged, with ubiquitous power providing generation units known as distribution generation units. A Microgrid can operate autonomously or with public grid connectivity. In the distributed power system, power quality problems start when the number of nonlinear loads and power-electronic distribution generation systems grows. This study conducts a few researches to improve power quality concerns utilizing FACTS devices.

Keywords- Electromagnetic interference, Flexible AC transmission system controllers, Microgrid, Power quality issues, Renewable Energy Sources,

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Design and Analysis of Flying Capacitor Multilevel Matrix Converter for aDFIG Machine based Wind System

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***Abstract*—People all around the globe are in desperate need of finding new sources of energy to provide them with the energy they need to survive. As the world's require for electrical energy increases, the world's fossil fuel supply will be worn-out within several years, according to the International Energy Agency.As a result, energy sources that are alternate or renewable must be created to fulfill future energy demands. Grid-connected wind capacity is growing at the quickest pace of any kind of renewable energy production, with worldwide 20–30 percent yearly growth rates are expected. Power electronic converters are important components of wind energy conversion systems because they regulate and condition the output power from wind energy. In recent years, there has been a lot of interest in matrix converters and multilevel converter topologies. This paper coverts the Flying Capacitor Multilevel Matrix Converter design inWind Energy Conversion System employingDoubly-Fed Induction Generator. The performance of converter is analyzed using the MATLAB/SIMULINK software.**

Keywords—DFIG Machine, Flying Capacitor Multilevel Matrix Converters, Grid,Matrix-Converter, SVPWM,Wind Turbine.

I. Introduction

Energy is a critical component of our everyday actions. As population increases, fossil fuel use falls, necessitating the consumption of more natural resources to satisfy the demand. Wind energy, more than any other renewable energy source, contributes to the transmission of information. It is significant because it has enormous potential in terms of giving power to people all over the globe. Wind energy, in contrast to other energy sources, does not involve the use of fuel in the manufacturing process; instead, it harnesses the power of the wind to create electricity. Energy costs may be reduced by using a renewable source like wind, which doesn't need to be transported or mined.

There are various advantages to using wind energy. Wind energy is indigenous to the region, and landowners and small enterprises may set up single turbines or clusters of turbines on their properties. It does not release toxins into lakes and streams, and it does not release dangerous airborne pollutants into the surrounding environment. Wind energy does not contribute to acid rain or global climate change, as is often believed. The majority of other forms of energy, such as coal and natural gas, contribute to the emission of carbon dioxide, Wind energy, on the other hand, emits none. Wind energyis also environmentally friendly.

The utilization of wind energy has a minor influence on agricultural output and cattle grazing since wind farms only cover a tiny percentage of the land area under cultivation. A wind energy conversion system typically consists of the following basic components: wind turbine, wind generator, connecting devices, and control systems. Vertical-axis and horizontal-axis wind turbines are distinguished by the orientation of their rotor blades during rotation.Wind turbines of the 21st century are HAWTs with two or three blades, and they are capable of functioning in either a downwind or an upwind position depending on the wind conditions. This HAWT can be built for either constant speed or variable speed operation, depending on the requirements of the given application. The more efficient variable speed wind turbine is also less stressful mechanically and noisier than the other type. However, in order to maintain a fixed frequency and constant power factor [1] variable speed turbines must be accompanied by complex power converters and control systems.

In recent years,according to the International Wind Energy Association, most of the variable-speed wind turbines in WECS are operated by Double - Fed Induction

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Fuzzy Logic-Based Pitch Angle Control for VariableSpeed Wind Systems

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***Abstract*—In this paper, a sophisticated control approach for variable-speed wind turbine systems based on fuzzy logic is devised. Power and rotational speed at the generator's output is used as input variables by the fuzzy logic controller (FLC).The FLC is responsible for generating the rotor position standard, which can correct for the pitch angle's nonlinear relationship to wind speed. The influencing factors for the engine's production strength and torque are utilized to smoothly govern the wind turbine so that the aerodynamic energy itself and in high-wind regions, velocity is maintained at the power ratings with little fluctuation.The method has been seen via utilizing simulated results for a windmill system with a 2.0-Megawatt perpetual synchronous motor.**

***Keywords*—Probabilistic Reasoning Controller, Pitch Angle Control, Perpetual Synchronous Machine, Windmill.**

I. Introduction

Due to the power crisis and environmental concerns, renewable energy, especially wind energy, has recently received a lot of attention. The effect that wind turbine systems have on the consistency of the frequency and voltage is becoming increasingly important as wind energy's integration into the electrical grid is substantially expanded. Consequently, from the perspective of grid integration, the power regulation method used by wind turbines is also becoming more significant. [1]

Depending on wind velocity, highly variable speed, varying wind turbine systems consist of two operating zones. In the partial-load area, when wind speeds are less than the rated-wind speed$\mathbf{V}_{rated}$, the turbine is kept spinning at an optimum speed, in order to capture the most energy from the wind turbine. Since the capacity of the generator and converter is constrained, In the filled zone, when the wind velocity exceeds its rated capacity, the output power of the generator is maintained at its rated value. On the other hand, the pitch regulation can be applied to the partial-load zone to smooth output power.[2]

Several methods of regulating the wind turbine's pitch angle have been developed for reducing the amount of kinetic energy it absorbs in high-wind conditions.Commonly used pitch angle controllers have been those based on proportional-integral (PI) or proportional-integral-derivative (PID) to regulate power. Whereas a generalized linear windmill model obtained by tiny analysis is used in the control system,The approach has the disadvantage that the effectiveness suffers if the operational points are changed. This is the method's primary downside.Alternately, a method was presented that provides great results of the turbine's electrical output in addition to resistance to wind speed and turbine characteristics fluctuations. But because the constraints need the weighting functions to change, the model's and the controller's parameters must also be adjusted.[3]

The linear quadratic Gaussian (LQG) approach has been utilized with regard to the planning of the rotor position management. In reference to the phase tolerances and increase margins, respectively, the LQG controller has earned a stellar reputation for its dependability. Furthermore, due to the large nonlinearities shown by the wind turbines, the efficacy of such a linear controller is greatly limited.[4]

A rotor position controller using the approach of generic control scheme has been suggested as a possible solution for a broad operating range of wind speed. By minimizing the performance index, this strategy minimizes the control signal error at each interval and eliminates its divergence.

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Arduino Based Metal Detector for Military Security

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ABSTRACT

The world's biggest and fastest-growing manufacturing sector is the electronic industry. Metal detectors are an electrical instrument that fascinates people. When properly designed and deployed, the world will be able to identify any metallic substance travelling by or approaching in close proximity. As an alert, this function would act as a security check for hazardous metallic stuff. Without the addition of a metal detector, no security system will be optimal or complete. A metal detector included within the gadget may detect metal items such as coins, nails, keys, and gold. This metal detector can identify some types of metal, particularly iron-containing metals (ferrous metal), even if they are hidden behind a half-inch of dry well or sand. The goal of this project is to design, create, and build a simple, inexpensive, and effective metal detector. The oscillator was used to build this metal detector. The primary goal of this project is to create a metal detector using electrical components that are readily accessible and inexpensive. Following the first and second world wars, one of the earliest widespread applications of metal detectors was the identification of land mines and unexploded bombs in a number of nations. This project provides an overview of the operating principle and uses of metal detectors.

Keywords- Arduino board, Buzzer, Diode, Power supply unit, Proximity sensor, Resistors

INTRODUCTION

We have experience working with a diverse assortment of materials, including metals and non-metals, among others. Examples of non-metal materials include things like plastic, wood, and several other non-metallic substances that we are already acquainted with. Ferrous metals and non-ferrous metals are the two types of metals that are distinguished by their magnetic properties [1]. In day-to-day life, metals are often used as power carriers, cooking utensils, and jewellery materials. They are also utilised for a variety of purposes in the military, including serving as the primary component of protective equipment such as mines. In the military, mines are commonly buried under the surface of the soil in a manner that will cause them to explode in the event that they are stomped on for an extended period of time. Mines include a variety of explosives, each with its own unique set of physical and chemical properties [2, 3]. It is not feasible to detect whether or not there are mines buried under the earth if one does not have access to any equipment. One of the pieces of equipment that is used in the process of determining the existence of mines is a metal detector [4]. Metal detectors make use of something called a "transmitter coil," which is a wire coil. As electrical current flows through the coil, it creates a magnetic field that surrounds the coil. When metal detectors are lifted off the ground, there will be a change in the magnetic field. When a magnetic field is maintained in close proximity to a piece of metal, the field has an effect on the atoms contained inside the metal and may even alter the flow of electrons. Users of this metal detector are at a considerable increased risk of becoming victims due to the fact that its operation still requires direct engagement from humans. Ease of executing a work is now a human requirement in carrying out its operations, allowing people to make technological breakthroughs. Technology is used to save time and money. One way to address these demands is to use robots technology, which may assist in the replacement of certain parts of human labor [5]. Of course, the employment of robots as a tool is created to be as near to what humans doing as feasible. Some robots are

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Single Phase Advanced Multilevel Inverter with Reduced Devices and THD for Industrial Applications

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***Abstract*—The utilization of Multilevel inverters are more popular in industrial and traction applications due to more advantages like less Harmonic distortion, less switching stresses and less count of switching devices. Here a novel single phase multilevel inverter is proposed which consist of less count devices i.e 6 switches, compare to conventional multilevel inverters like diode clamped, cascaded and flying capacitor inverters. It has capability to operate like symmetrical five level and unsymmetrical seven level inverter. Utilizing the sinusoidal pulse width modulation technique, inverter controllability is achieved and the THD analysis of output voltage is analyzed by various techniques. Ease of operation and conversion with less count of switches validates the inverter. The implementation of the inverter is simulated using MATLAB/SIMULINK environment.**

Keywords—Multilevel inverter, modulation index, 5-level., 7-level, SPWM techniques, and THD

I. Introduction

Because of rise of utilization of multilevel inverters in industrial, PV system and traction applications with importance of compact switching device which one rise cost to the product. The cost of devices is more important in industrial and power systems applications. So based on above one many few research works on new topologies with reduced devices being developed an inverter that can drive multi loads. Generally various multilevel inverters like diode clamped, cascaded and flying capacitor multilevel inverters are implemented, because of their advantages and disadvantages [1-3] in drive applications. Cascaded H-bridge multilevel inverters are more gaining in recent years because of very simple controllability. But this topology attain by more no of switching devices and DC sources. Due to its preferred advantages, such as lower switching frequency, reduced dv/dt, and lower THD, the neutral point-clamped (NPC) is employed for PV systems. But, this NPC has drawback of voltage sharing across the switches. In order to reduce the draw backs of above various researcher developed various topologies with reduced components [4-6]. With use of less count of switches in MLI it improves the system efficiency by reducing the switching and conduction losses.

Harmonics content in voltage and current wave cause the distortions and make it non sinusoidal. Hence it is needed to reduce harmonic and improve the THD and efficiency of the system. In order to provide the pure sinusoidal output voltage by MLI, various Pulse width modulation techniques are developed by many researchers. Generally SPWM and SVPWM techniques are used to control the MLI to provide pure sinusoidal output wave. In [7–10], a variety of multicarrier PWM strategies are analysed for controlling the MLI. The THD of the output voltage was decreased and pure sinusoidal output waveforms were provided by the employment of the abovementioned multi carrier PWM approaches. In an endeavour to reduce component costs and lower the harmonic content of voltage and current. Here a new topology is introduced with reduced switching components and dc sources.

II. Proposed Multi Level Inverter

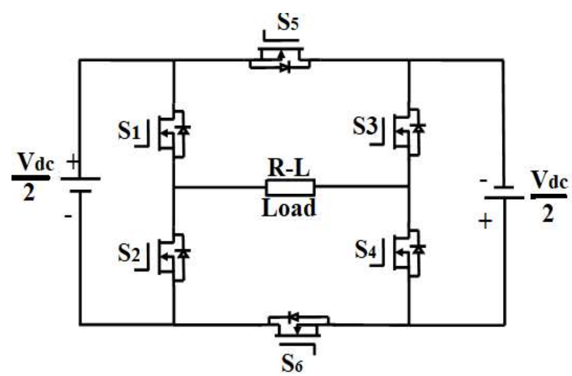

Fig. 1. Level inveter

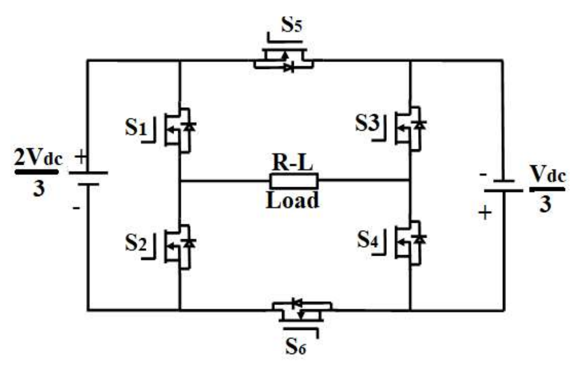

Fig. 2. Level inveter

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Design and Analysis of Flying Capacitor Multilevel Matrix Converter for aDFIG Machine based Wind System

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Abstract—**People all around the globe are in desperate need of finding new sources of energy to provide them with the energy they need to survive. As the world's require for electrical energy increases, the world's fossil fuel supply will be worn-out within several years, according to the International Energy Agency.As a result, energy sources that are alternate or renewable must be created to fulfill future energy demands. Grid-connected wind capacity is growing at the quickest pace of any kind of renewable energy production, with worldwide 20–30 percent yearly growth rates are expected. Power electronic converters are important components of wind energy conversion systems because they regulate and condition the output power from wind energy. In recent years, there has been a lot of interest in matrix converters and multilevel converter topologies. This paper coverts the Flying Capacitor Multilevel Matrix Converter design inWind Energy Conversion System employingDoubly-Fed Induction Generator. The performance of converter is analyzed using the MATLAB/SIMULINK software.**

Keywords—DFIG Machine, Flying Capacitor Multilevel Matrix Converters, Grid,Matrix-Converter, SVPWM,Wind Turbine.

I. INTRODUCTION

Energy is a critical component of our everyday actions. As population increases, fossil fuel use falls, necessitating the consumption of more natural resources to satisfy the demand. Wind energy, more than any other renewable energy source, contributes to the transmission of information. It is significant because it has enormous potential in terms of giving power to people all over the globe. Wind energy, in contrast to other energy sources, does not involve the use of fuel in the manufacturing process; instead, it harnesses the power of the wind to create electricity. Energy costs may be reduced by using a renewable source like wind, which doesn't need to be transported or mined.

There are various advantages to using wind energy. Wind energy is indigenous to the region, and landowners and small enterprises may set up single turbines or clusters of turbines on their properties. It does not release toxins into lakes and streams, and it does not release dangerous airborne pollutants into the surrounding environment. Wind energy does not contribute to acid rain or global climate change, as is often believed. The majority of other forms of energy, such as coal and natural gas, contribute to the emission of carbon dioxide, Wind energy, on the other hand, emits none. Wind energyis also environmentally friendly.

The utilization of wind energy has a minor influence on agricultural output and cattle grazing since wind farms only cover a tiny percentage of the land area under cultivation. A wind energy conversion system typically consists of the following basic components: wind turbine, wind generator, connecting devices, and control systems. Vertical-axis and horizontal-axis wind turbines are distinguished by the orientation of their rotor blades during rotation.Wind turbines of the 21st century are HAWTs with two or three blades, and they are capable of functioning in either a downwind or an upwind position depending on the wind conditions. This HAWT can be built for either constant speed or variable speed operation, depending on the requirements of the given application. The more efficient variable speed wind turbine is also less stressful mechanically and noisier than the other type. However, in order to maintain a fixed frequency and constant power factor [1] variable speed turbines must be accompanied by complex power converters and control systems.

In recent years,according to the International Wind Energy Association, most of the variable-speed wind turbines in WECS are operated by Double - Fed Induction

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Single Phase Advanced Multilevel Inverter with Reduced Devices and THD for Industrial Applications

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***Abstract*—The utilization of Multilevel inverters are more popular in industrial and traction applications due to more advantages like less Harmonic distortion, less switching stresses and less count of switching devices. Here a novel single phase multilevel inverter is proposed which consist of less count devices i.e 6 switches, compare to conventional multilevel inverters like diode clamped, cascaded and flying capacitor inverters. It has capability to operate like symmetrical five level and unsymmetrical seven level inverter. Utilizing the sinusoidal pulse width modulation technique, inverter controllability is achieved and the THD analysis of output voltage is analyzed by various techniques. Ease of operation and conversion with less count of switches validates the inverter. The implementation of the inverter is simulated using MATLAB/SIMULINK environment.**

Keywords—Multilevel inverter, modulation index, 5-level., 7-level, SPWM techniques, and THD

I. INTRODUCTION

Because of rise of utilization of multilevel inverters in industrial, PV system and traction applications with importance of compact switching device which one rise cost to the product. The cost of devices is more important in industrial and power systems applications. So based on above one many few research works on new topologies with reduced devices being developed an inverter that can drive multi loads. Generally various multilevel inverters like diode clamped, cascaded and flying capacitor multilevel inverters are implemented, because of their advantages and disadvantages [1-3] in drive applications. Cascaded H-bridge multilevel inverters are more gaining in recent years because of very simple controllability. But this topology attain by more no of switching devices and DC sources. Due to its preferred advantages, such as lower switching frequency, reduced dv/dt, and lower THD, the neutral point-clamped (NPC) is employed for PV systems. But, this NPC has drawback of voltage sharing across the switches. In order to reduce the draw backs of above various researcher developed various topologies with reduced components [4-6]. With use of less count of switches in MLI it improves the system efficiency by reducing the switching and conduction losses.

Harmonics content in voltage and current wave cause the distortions and make it non sinusoidal. Hence it is needed to reduce harmonic and improve the THD and efficiency of the system. In order to provide the pure sinusoidal output voltage by MLI, various Pulse width modulation techniques are developed by many researchers. Generally SPWM and SVPWM techniques are used to control the MLI to provide pure sinusoidal output wave. In [7–10], a variety of multicarrier PWM strategies are analysed for controlling the MLI. The THD of the output voltage was decreased and pure sinusoidal output waveforms were provided by the employment of the abovementioned multi carrier PWM approaches. In an endeavour to reduce component costs and lower the harmonic content of voltage and current. Here a new topology is introduced with reduced switching components and dc sources.

II. PROPOSED MULTI LEVEL INVERTER

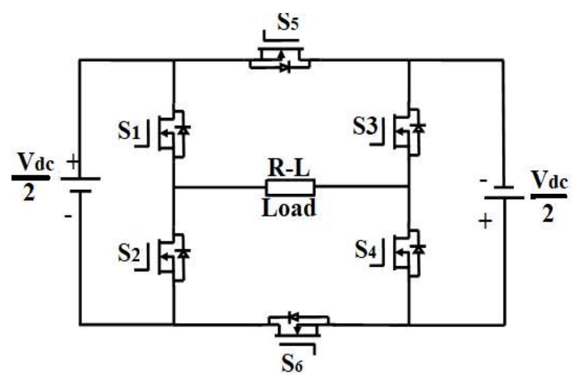

Fig. 1. Level inveter

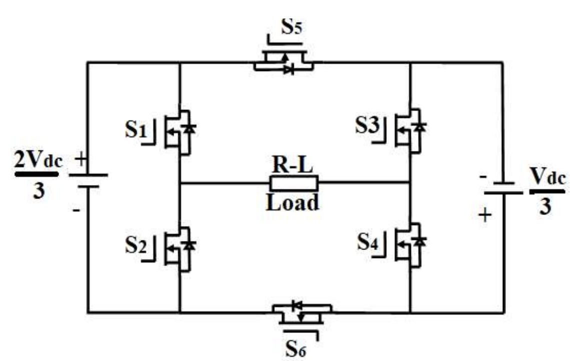

Fig. 2. Level inveter

Voltage and Frequency Control of a PV-Battery-Diesel Generator based Standalone Hybrid System

Publisher: IEEE

M. Bhagya Lakshmi ; S. Saravanan ; Muhammet serhat Düzdağ ; Heybet Kılıç ; T. Anuradha ; Karanam Deepak ; Jagan Mohana Rao Malla ;… All Authors

Abstract: An effective controller is proposed for the "Photovoltaic(PV) – Battery - Diesel Generator(DG)" based hybrid standalone system in this article. A bidirectional DC to DC d... **View more**

Metadata

Abstract:

An effective controller is proposed for the "Photovoltaic(PV) – Battery - Diesel Generator(DG)" based hybrid standalone system in this article. A bidirectional DC to DC device which can allow power in both directions is integrated among the DC-link and battery bank to maintain contact voltage by maintaining power balance in the system. Further, a bidirectional inverter is also considered between point of common coupling (PCC) and DC-link for providing supply to AC loads as well as charging the battery from diesel generator based on requirement. However, the phenomenon of partial shading condition (PSC) commonly occurring on PV modules and also generated power from PV always fluctuates according to changes in weather. To achieve a superior performance of the system, a Takagi-Sugeno Fuzzy (TSF) based controllers are implemented in proposed control schemes. The novel control schemes are implemented on a bidirectional DC to DC converter as well as three phase bidirectional inverter. However, the proper deloading process of the PV system should be incorporated into the controller of the DC to DC converter to achieve power balance during light load conditions. Balanced quality voltages (3-phase) at PCC are achieved by inverter control which forces to maintain balanced currents generated by DG during the operation of unbalanced loads. Maintaining balanced DG currents can help to reduce the oscillations on the torque of the shaft which increases the fatigue life. Further the reactive power demanded at PCC is compensated by the inverter control, hence DG need not to provide it which results can reduce the consumption of diesel. Various case studies are examined by using MATLAB to present results and Real Time Digital Simulator (RTDS) based results are also provided in this paper.

Published in: 2022 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES)

Enhancement of Power Quality in Distribution System using DSTATCOM

Publisher: IEEE

M Bhagya Lakshmi ; Karanam Deepak ; Mulinti Sindhuja ; Kallapari Mounika ; Desai Parthyusha ; Omkaram Sowjanya **All Authors**

Abstract: Consumers required always quality power at load bus. Therefore, it is essential to use specialized power devices, such as FACTS devices, in distribution systems. A DSTATC... **View more**

Metadata

Abstract:
Consumers required always quality power at load bus. Therefore, it is essential to use specialized power devices, such as FACTS devices, in distribution systems. A DSTATCOM is mostly used device which is connected very near to load bus for improving power quality. Usually, high reactive power will be demanded by loads connected at load bus. This demanded reactive power will cause decrease in RMS voltage at load bus. Hence a proper controller is required to maintain constant voltage during changes in loads by compensating reactive power which demanded by loads. With the proposed method, stable and constant voltage is maintained at load bus during changes in load. Under various operating situations, extensive findings are presented using MATLAB/Simulink. The detailed modeling and control strategy of DSTATCOM is also included in this paper.

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Date Added to IEEE *Xplore*: 25 April 2023

Publisher: IEEE

ISBN Information:

Conference Location: Erode, India

A Novel Method of Current Fed Dual Bridge DC to DC Converter with ZVS

Publisher: IEEE

Karanam Deepak ; M Bhagya Lakshmi ; P Riyaz ; Bondili Veerendra singh ; A. Sathish ; vadde siva Kumar **All Authors**

Abstract:DC to DC converters' applications are sporadic expanding due to their many benefits and simplicity. A dual bridge DC to DC converter with zero dead time and a low cost fi... **View more**

Metadata

Abstract:

DC to DC converters' applications are sporadic expanding due to their many benefits and simplicity. A dual bridge DC to DC converter with zero dead time and a low cost filter inductor is presented here as part of this study. When compared to other typical full bridge converters, the suggested dual bridge DC to DC converter has lower input current ripples, less stress on switches, and a requirement for a smaller inductor for filtering. Further the dead time is not present in the operation of proposed converter but it is existed in conventional converter. Lower inductance size can improve the transient speed and reduces the size of filter in output which helps to improve power density. This paper explains the suggested topology's operation in detail. To examine the suggested topology under various operating situations, the MATLAB/Simulink programme is utilised.

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ISBN Information:

Conference Location: Uttarakhand, India

Arduino Based Metal Detector for Military Security

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[1]Associate Professor, [2]Assistant Professor, Department of Electrical and Electronics Engineering, G. Pullaiah College of Engineering & Technology, Kurnool, Andhra Pradesh, India

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ABSTRACT

The world's biggest and fastest-growing manufacturing sector is the electronic industry. Metal detectors are an electrical instrument that fascinates people. When properly designed and deployed, the world will be able to identify any metallic substance travelling by or approaching in close proximity. As an alert, this function would act as a security check for hazardous metallic stuff. Without the addition of a metal detector, no security system will be optimal or complete. A metal detector included within the gadget may detect metal items such as coins, nails, keys, and gold. This metal detector can identify some types of metal, particularly iron-containing metals (ferrous metal), even if they are hidden behind a half-inch of dry well or sand. The goal of this project is to design, create, and build a simple, inexpensive, and effective metal detector. The oscillator was used to build this metal detector. The primary goal of this project is to create a metal detector using electrical components that are readily accessible and inexpensive. Following the first and second world wars, one of the earliest widespread applications of metal detectors was the identification of land mines and unexploded bombs in a number of nations. This project provides an overview of the operating principle and uses of metal detectors.

Keywords- Arduino board, Buzzer, Diode, Power supply unit, Proximity sensor, Resistors

INTRODUCTION

We have experience working with a diverse assortment of materials, including metals and non-metals, among others. Examples of non-metal materials include things like plastic, wood, and several other non-metallic substances that we are already acquainted with. Ferrous metals and non-ferrous metals are the two types of metals that are distinguished by their magnetic properties [1]. In day-to-day life, metals are often used as power carriers, cooking utensils, and jewellery materials. They are also utilised for a variety of purposes in the military, including serving as the primary component of protective equipment such as mines. In the military, mines are commonly buried under the surface of the soil in a manner that will cause them to explode in the event that they are stomped on for an extended period of time. Mines include a variety of explosives, each with its own unique set of physical and chemical properties [2, 3]. It is not feasible to detect whether or not there are mines buried under the earth if one does not have access to any equipment. One of the pieces of equipment that is used in the process of determining the existence of mines is a metal detector [4]. Metal detectors make use of something called a "transmitter coil," which is a wire coil. As electrical current flows through the coil, it creates a magnetic field that surrounds the coil. When metal detectors are lifted off the ground, there will be a change in the magnetic field. When a magnetic field is maintained in close proximity to a piece of metal, the field has an effect on the atoms contained inside the metal and may even alter the flow of electrons. Users of this metal detector are at a considerable increased risk of becoming victims due to the fact that its operation still requires direct engagement from humans. Ease of executing a work is now a human requirement in carrying out its operations, allowing people to make technological breakthroughs. Technology is used to save time and money. One way to address these demands is to use robots technology, which may assist in the replacement of certain parts of human labor [5]. Of course, the employment of robots as a tool is created to be as near to what humans doing as feasible. Some robots are

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Performance Evaluation of Spider Web Tie (S-B-T) PV Panel Configuration to Reduce PV Mismatch Losses

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Keywords:
BL, PV, PSC, S-B-T, S-P, T-C-T, T-T, Configurations, Photovoltaic

ABSTRACT

In non-uniform conditions, the power curve of a solar plant can vary significantly, which can affect the performance of the system. In such conditions, the configuration of the panels can help reduce the mismatch losses. Although dedicated electronics may be helpful in reducing a panel's mismatch, the panel configuration is a recent solution that can also reduce a panel's overall power consumption and mismatch losses. Hence in this paper Sider Web Tie (S-B-T) PV panel configuration is proposed. A test case of 5 X 5 200 W PV panel is considered. The proposed S-B-T PV configuration is implemented under real time PSC's in comparison with Series-Parallel (S-P), Total Cross-Tied (T-C-T), Triple-Tied (T-T), Bridge-Link (B-L) configurations. The factors such as PV mismatch losses, Max. current and voltage, OC Voltage, SC Current that influence the performance of the system are investigated. In all the cases proposed Spider Web Tie (S-B-T) PV configuration exhibits the superior performance.

1. INTRODUCTION

Due to its various advantages, solar panels have become an integral part of the energy landscape. They are more advantageous than traditional sources of energy. The feasibility of solar energy has become an attractive factor for the energy market. The global solar photovoltaics market continued to grow in 2021 with new capacity additions reaching 175 gigawatts. The global solar PV capacity grew by 36 gigawatts in 2021 to reach 942 gigawatts. Despite the various disruptions in the solar value chain, the market continued to grow. The increase in capacity was mainly due to the sharp rise in the prices of raw materials and shipping. In 2021, several countries had enough solar PV generation capacity to meet at least a 10% of their electricity demand. This is significantly higher than the two countries in 2020. At least 18 countries also have enough solar PV generation capacity to meet 5% of their electricity needs. Australia had the highest annual share of solar PV at 15.5%, followed by Greece, Spain, Honduras, Germany, and the Netherlands. In total, solar PV contributed about 5% of global electricity generation in 2021.

In 2021, the country's distributed rooftop installations reached an all-time high, and they are expected to contribute around 17% of the country's total solar market. The commercial and industrial sector is expected to be the biggest contributor to the country's solar growth, as it accounts for over 51% of the country's electricity generation. Despite the government's efforts to encourage the growth of the solar industry, the implementation of solar power projects has been hindered by various factors. In December 2020, the government announced that it would only allow PV installations with up to 10 kilowatts of power to be eligible for net metering. However, in April 2021, the government modified this policy to allow installations with up to 500 kilowatts.

The PV system was first introduced in 1954. The first PV cell is made with the impurities of silicon, which can convert the sunlight into electricity. The efficiency of this cell has been estimated to be around 4% to 24% [1-4]. Various factors such as partial shading, hotspots, and diode failure can affect the efficiency of solar PV system. This issue usually causes losses in the system and cannot be predicted. This partial shading mismatch causes losses in the power supply of the PV system. This issue can be solved through various means, such as by reducing the number of unshaded healthy cells in the system [5-8]. The maximum power point refers to the point at which the system can generate the maximum amount of power. It can be obtained from the characteristic curves of P-V.

The non-linear relationship between current and voltage of PV module is the main factor that influences its performance. Other factors such as temperature and solar insolation can also affect its efficiency and performance [9]. Partial shading conditions (PSCs) are the main factors that affect the generation of power from a PV module. These conditions happen due to the varying levels of insolation in an array. As a result, the mismatched current levels created by the insolation can lead to power loss in the shaded modules. This characteristic causes the multiple local maximum peak power (LMPPs), which are also known as the GMPP, to occur along with the observed PV array output current. This is a major disadvantage of the traditional MPPT methods. To get the

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Comparative Performance Evaluation of PV Configurations Under Various Shaded Conditions

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***Abstract*—Partial shading is a common issue that occurs in building roof-top PV arrays. This condition generally occurs due to the shadows of the buildings and clouds around them. In most cases, partial shading causes mismatched losses in the solar PV system. This issue usually affects the power output of the healthy modules. Hence in this paper simulation and modeling approach for solar PV system setups with varying shading scenarios. The results show that the performance of various configurations of the system under different shaded conditions. A 200 W 5X5 size PV panels are considered as test case. A comparison analysis is then carried out for the various parameter of the solar PV system, such as the Fill Factor FF (%), PV Mismatch losses Pml (%), Efficiency η (%), Maximum Power Pmp (W). Detailed comparison charts are presented. In the all the above parameters TCT shows the best performance next to TT configuration.**

Keywords— PV Configuration, PV Mismatch losses Pml (%), Fill Factor FF (%), Efficiency η (%), Power Maximum Pmp (W).

I. Introduction

Despite the technological advances in the field of electricity generation, most of the energy consumption still remains concentrated on fossil fuels. This has caused the rise of alternative energy sources such as wind and solar. Due to the various advantages of solar energy, PV has gained the attention of the public. One of these is its low maintenance costs. Also, it's simple to install and use. It was another record-breaking year for solar PV installations. According to the latest data, the total installed capacity globally reached 760 gigawatts, [1] which is equivalent to almost 2 percent of the world's total electricity supply. The outbreak of the COVID-19 pandemic reduced electricity consumption and affected daily demand patterns. It also caused delays in the shipment and delivery of solar panels and related equipment. Despite the pandemic, solar PV still managed to achieve its largest increase in capacity in a single year. This was despite the weak economic conditions in some of the markets. The end of the year brought about various changes in the policies in various countries, which led to the growth of the top three markets. The continuous growth of the PV industry has allowed it to expand its power capacity at a fast pace. In 2018, it became possible to supply the world's total electricity demand. [2]-[3] The global PV installed capacity is shown in Fig. 1.

Various environmental challenges are involved in the efficiency of solar PV. These issues can be easily ignored for a short time period. On the other hand, the environmental problems of PV plants are usually resolved on the higher level [4. For instance, the issue of over-heating is usually solved through the use of thermal management techniques.

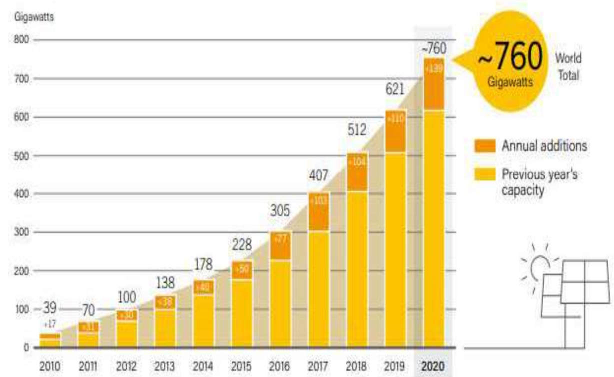

Fig. 1 Global PV Installed Capacity [1]

The main factors that cause solar shading are located near high rise commercial buildings and telecommunications towers. Researchers are usually reluctant to address the issue of shadowing due to its negative effects on the performance of the solar PV system. Various configurations such as series, bridge link, total-cross-tie, and honey-comb are also commonly used in designing and implementing solar PV arrays. These are necessary to maximize the power output of the system. [5]

This paper presents a simulation and modeling approach for solar PV system setups with varying shading scenarios. The results show that the performance of various configurations of the system under different shaded conditions. A comparison analysis is then carried out for the various parameter of the solar PV system

II. Case System

This paper presents a 200W, 5 X 5 panels are considered as a test case. The various configurations of the system are evaluated under various shading conditions. The PV configurations evaluated in this paper are shown in Fig. 2.

Takagi-Sugeno-Kang Fuzzy Controllers for Single Stage Grid Connected PV System

Publisher: IEEE

Y Hazarathaiah ; B V Rami Reddy **All Authors**

Abstract: Grid connected solar power plants are widely established in many places worldwide. Photovoltaic (PV) based grid connected solar plants are attracting recently due to impr... **View more**

Metadata

Abstract:

Grid connected solar power plants are widely established in many places worldwide. Photovoltaic (PV) based grid connected solar plants are attracting recently due to improved in controlling of power converters. Single stage grid connected systems can reduce number of converters connected in power plants which resultant in reduce cost of the system. However, DC to DC converters are generally used in PV systems to enhance the operation of maximum power point for best utilization. The inverters also can be using to extract maximum power from PV systems through new controlling techniques in power electronics devises. Therefore an extra DC to DC converter is not required to make PV at its maximum power point condition. However, this technology can be used for small scale solar power plants since all PV arrays in solar power plant cannot be received same irradiance. Takagi-Sugeno-Kang (TSK) fuzzy controller is having significant priority than proportional plus integral controllers when rapid changes are having in input. Hence, TSK based single stage controller is developed in this paper for grid connected 1MW solar plant. Generally distribution system is connected with unbalanced loads, hence these unbalanced loads will create forcefully unbalanced currents in electrical grid. Unbalanced grid currents further create many problems to other loads. Therefore, the proposed controller is designed to help making grid currents balanced during unbalanced local loads. Further, the inverter can compensate reactive power demanded by local loads to minimize reactive power supplied by grid. On the OPAL-RT platform, extensive data are provided and assessed in order to improve the performance of the proposed controller for a 1MW grid-connected solar plant.

Power Quality Improvement of Standalone Microgrid during Faults on Distribution Line with DSTATCOM

Publisher: IEEE Cite This PDF

Y Indira Priya Darshini ; Karanam Deepak ; U Chaithanya ; Y Hazarathaiah ; D Vannurappa ; Dr. Siva Ganesh Malla **All Authors**

Abstract: The voltage control of a wind energy based hybrid standalone Microgrid subjected to the faults on distribution feeders is presented in this paper. The effects of faults o... **View more**

Metadata

Abstract:
The voltage control of a wind energy based hybrid standalone Microgrid subjected to the faults on distribution feeders is presented in this paper. The effects of faults on the Microgrid are analyzed and required control measures are implemented to stabilize the turbine speed as well as to improve the quality of voltage at AC load bus. The controller of the existing maximum power point tracker (MPPT) is modified to limit the turbine speed during the fault(s). Distribution static shunt compensator (DSTATCOM) is further considered at AC load bus to provide the support for stabilizing the voltage during faults. Its novel control is presented to maintain the PCC voltages within allowable limits after occurrence of fault. Moreover, the connected DSTATCOM can also compensate for the reactive power demanded by the load. Further, with the help of DSTATCOM, torque pulsations induced in the generator due to unbalanced load are reduced. Fuel Cell and Electrolyzer are incorporated into the system to supply the reliable power at the load bus. The performance of Fuel Cell and Electrolyzer is also evaluated under the condition of fault. Extensive results based on case studies are presented in this paper with the help of MATLAB/SIMULINK package. The performances of proposed controllers are examined under unbalanced load as well as under different faults to show the satisfactory responses.

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Power Quality Improvement of Standalone Microgrid during Faults on Distribution Line with DSTATCOM

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Y Indira Priya Darshini ; Karanam Deepak ; U Chaithanya ; Y Hazarathaiah ; D Vannurappa ; Dr. Siva Ganesh Malla **All Authors**

Abstract: The voltage control of a wind energy based hybrid standalone Microgrid subjected to the faults on distribution feeders is presented in this paper. The effects of faults o... **View more**

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Abstract:
The voltage control of a wind energy based hybrid standalone Microgrid subjected to the faults on distribution feeders is presented in this paper. The effects of faults on the Microgrid are analyzed and required control measures are implemented to stabilize the turbine speed as well as to improve the quality of voltage at AC load bus. The controller of the existing maximum power point tracker (MPPT) is modified to limit the turbine speed during the fault(s). Distribution static shunt compensator (DSTATCOM) is further considered at AC load bus to provide the support for stabilizing the voltage during faults. Its novel control is presented to maintain the PCC voltages within allowable limits after occurrence of fault. Moreover, the connected DSTATCOM can also compensate for the reactive power demanded by the load. Further, with the help of DSTATCOM, torque pulsations induced in the generator due to unbalanced load are reduced. Fuel Cell and Electrolyzer are incorporated into the system to supply the reliable power at the load bus. The performance of Fuel Cell and Electrolyzer is also evaluated under the condition of fault. Extensive results based on case studies are presented in this paper with the help of MATLAB/SIMULINK package. The performances of proposed controllers are examined under unbalanced load as well as under different faults to show the satisfactory responses.

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A Novel Control of DC to DC Converter for Renewable Energy Sources

Publisher: IEEE

U Chaithanya ; Karanam Deepak ; Dakshayani Besta ; Masira Khatoon ; Mala Samyuktha ; Pasupula Mounisha **All Authors**

Abstract: Electrical power generation is essential for supply to loads. Hybrid renewable energy sources for grid integration becomes popular and increasing interest every day in wo... **View more**

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Electrical power generation is essential for supply to loads. Hybrid renewable energy sources for grid integration becomes popular and increasing interest every day in worldwide. The integration of more sources can establish a strong system. A PMSG coupled wind power generation and photovoltaic (PV) systems are popular societies. However, both sources are depending on nature hence a battery needs to be attached to the system for making stable operation during all the condition. Batteries are incredibly efficient and effective energy storage components that, with proper charging and discharging control, may minimize system fluctuations. To connect batteries to the DC network and ensure adequate current flow for charging or discharging the batteries, a bidirectional DC to DC converter is required. To ensure optimal battery charging and discharging, this work employs a bidirectional DC to DC converter and suggests a control strategy. Individual maximum power point tracker (MPPT) devices have appropriate renewable energy conversion systems incorporated in them to maximize their use. Extensive results are presented in this paper under many possible conditions with the help of MATLAB/Simulink package.

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Enhancement of Power Quality in Distribution System using DSTATCOM

Publisher: IEEE

M Bhagya Lakshmi ; Karanam Deepak ; Mulinti Sindhuja ; Kallapari Mounika ; Desai Parthyusha ; Omkaram Sowjanya **All Authors**

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A Novel Method of Current Fed Dual Bridge DC to DC Converter with ZVS

Karanam Deepak ; M Bhagya Lakshmi ; P Riyaz ; Bondili Veerendra singh ; A. Sathish ; vadde siva Kumar **All Authors**

Abstract:DC to DC converters' applications are sporadic expanding due to their many benefits and simplicity. A dual bridge DC to DC converter with zero dead time and a low cost fi... **View more**

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DC to DC converters' applications are sporadic expanding due to their many benefits and simplicity. A dual bridge DC to DC converter with zero dead time and a low cost filter inductor is presented here as part of this study. When compared to other typical full bridge converters, the suggested dual bridge DC to DC converter has lower input current ripples, less stress on switches, and a requirement for a smaller inductor for filtering. Further the dead time is not present in the operation of proposed converter but it is existed in conventional converter. Lower inductance size can improve the transient speed and reduces the size of filter in output which helps to improve power density. This paper explains the suggested topology's operation in detail. To examine the suggested topology under various operating situations, the MATLAB/Simulink programme is utilised.

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Performance Comparisons of Multilevel Inverter Topologies

Publisher: IEEE

Karanam Deepak ; U Chaithanya ; M Lingmaiah ; Shaik Abdul Siraj ; K Narahari Kalyan Kumar ; Nageti Aravind **All Authors**

Abstract: Applications of multilevel inverters are increasing day by day due to their capability to operate for higher voltage with less harmonic components at output terminals. Th... **View more**

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Abstract:

Applications of multilevel inverters are increasing day by day due to their capability to operate for higher voltage with less harmonic components at output terminals. The Neutral Point Clamped (NPC) and Cascaded H-Bridge (CHB) inverters are two well-known multilevel inverter topologies that are used as traditional converters. Different methods of producing pulses to activate semiconductor switches in multilevel inverters are used to minimize harmonics. Pulse Width Modulation (PWM) methodologies for multilevel inverters are introducing every day to make system more applicable. Among many, a Sinusoidal PWM (SPWM) technique is a popular method for generating pulses to switches. Compared to NPC, the structure of CHB is simple and having more futures. However, for a higher level, number of switches of inverter goes increase. Hence, asymmetrical CHB configuration is implemented with a smaller number of switches for higher levels. Various multilevel topologies with suitable SPWM methods are proposed in this paper. For analysis of proposed configuration, five and fifteen level inverters of CHB configuration is presented with phase and line voltages. Extensive results are presented in this paper with the help of MATLAB/Simulink package.

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Novel Control of Standalone Hybrid Wind-PV-Battery System for Improving Power Quality

Publisher: IEEE

Karanam Deepak ; Y Hazarathaiah ; U Chaithanya ; Nandavaram Abbai Charan ; Chowdary Mohammed Awaise ; Puttapogu Sinjith **All Authors**

Abstract: Standalone hybrid power generation systems, particularly those using renewable energy sources, are gaining popularity and spreading across the globe. Solar and wind power... **View more**

Metadata

Abstract:

Standalone hybrid power generation systems, particularly those using renewable energy sources, are gaining popularity and spreading across the globe. Solar and wind power are two of the main renewable energy sources used to generate electricity. Solar energy is typically converted into electricity using photovoltaic (PV) cells, and similarly, wind energy conversion systems based on PMSG are more common for medium power applications. Hence, PV and wind based hybrid standalone system can provide reliable power to loads with the help of battery storage system. The integration of these two generations along with battery can provide flexible and reliable power to consumers during all times. To maintain power quality at the AC load bus, a hybrid PV, wind, and battery-based microgrid is therefore taken into consideration and installed. Maximum power point devices are integrated into the system to make the most use of the energy sources. A bidirectional DC to DC converter connects the battery bank to the system in order to maintain energy management. By properly charging and discharging the battery, the bidirectional DC to DC converter's control mechanism regulates the voltage of the dc-link. Between dc-link and AC loads is an interface for a three-phase inverter. Regardless of variations in load and sources, the control of the inverter is built to maintain constant RMS voltage at the AC bus. In this research, the outcomes under several case studies are presented using the MATLAB platform.

Published in: 2023 Second International Conference on Electronics and Renewable Systems (ICEARS)

Enhancement of Power Quality in Distribution System using DSTATCOM

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A Novel Method of Current Fed Dual Bridge DC to DC Converter with ZVS

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Performance Analysis of Distributed Power Flow Controller Employing Genetic-Based Fuzzy Logic Controller in Photovoltaic-Wind Hybrid System

V. Sowmya Sree and C. Srinivasa Rao

Abstract The deployment of hybrid non-conventional energy sources has become inevitable due to decrease in natural resources, global warming, growing energy costs, and expanding electrical consumption are all factors to consider. Because solar and wind energy are both free and environmentally beneficial, they are regarded as the finest options for remote (or rural) electricity. The combination of solar power and wind power is a reliable source of energy creating a constant energy flow by avoiding the fluctuations. But this hybrid system gives rise to complications related to power system stability. Most of the industrial loads are controlled by power electronic converters that are sensitive to power system disturbances. Hence, the power quality issues diminution is more focused in recent times as it is vital in power supply industry. A number of FACTS devices such as power semiconductor devices are developed to overcome the above power quality issues. Distributed power flow controller (DPFC), which is emerged from unified power flow controller, is considered as the best reliable device among the others. The DC link is the key distinction between these devices. In the case of DPFC, the DC connection that links both converters does not exist. This paper presents the performance analysis of DPFC when operating with and without genetic algorithm-based fuzzy logic controller, and the simulation results are validated using MATLAB/Simulink software.

Keywords Distributed power flow controller (DPFC) · Fuzzy logic controller (FLC) · Genetic fuzzy logic controller (GFLC) · Power quality · Solar and wind system

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Mitigation of Power Quality Issues in Hybrid Solar-Wind Energy System using Distributed Power Flow Controller

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***Abstract*— Renewable Energy Sources find a scope for the prospects in meeting the growing demand with high power quality and reliability. This has led to the concept of Micro-grid with widespread power supplying generation units called distribution generation units. The operation of a Micro-grid can be autonomous or with public grid interconnection. The combination of solar power and wind power is a reliable source of energy creating a constant energy flow by avoiding the fluctuations. The increase in penetration of non-linear loads and power-electronic incorporated distribution generation system initiates power quality disputes in the distributed power system. Hence, the mitigation of power quality issues is more fixated and few investigations led to the use of FACTS devices such as custom power semiconductor devices for this purpose. Distributed Power Flow Controller, which is emerged from Unified Power Flow Controller, is considered as the most reliable device among all the devices. The main difference between these devices is the absence of DC-link in Distributed Power Flow Controller. This paper presents the enactment of Solar-wind hybrid system without custom power device and with Distributed Power Flow Controller. The simulation results are validated using MATLAB/SIMULINK software.**

Keywords*— Distributed Power Flow Controller (DPFC), Power quality, Solar and Wind System.

I. Introduction

Now-a-days the renewable energy-based power systems play a major role replacing the conventional sources-based power systems. The main advantage of renewable energy sources is that they are environment-friendly and do not produce any greenhouse gases during generation of electricity. Solar energy and wind energy are considered as rapid developing sources globally. The solar power depends on the solar irradiance and wind power depends on wind speed instantly. But the photovoltaic and wind energy sources create frequency and voltage oscillations in power system due to its intermittent nature [1-3]. Therefore, the renewable energy sources inject a fluctuating power into the grid.

Power quality is the major problem faced by an integrated microgrid system [4]. The different types of power quality issues in a micro grid are caused by sudden changes in load, under voltage load shedding, sudden loss of resource, faults at load side and during islanding. The major source of poor power quality in the network is voltage unbalance [5-6]. The use of FACTS controllers is considered to be the best solution for power system stability problems especially steady-state control. The expansion of FACTS devices started with increasing capabilities of power electronic components [7]. Fig.1 shows the classification of FACTS controllers.

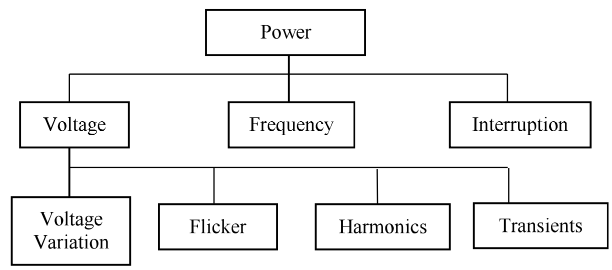

Fig. 1 Classification of Power Quality Issues

In this paper, the authors proposed a novel device called Distributed Power Flow Controller (DPFC), which is an advanced version of Unified Power Flow Controller for improving the operation of power system network [8]. The absence of DC link between the converters is the major difference between DPFC and UPFC. In DPFC, the third frequency harmonic component acts as link between both converters for dynamic power trading [9].

In view of the above, the proposed dynamic system is presented in section-2. The detailed analysis of Simulation results is presented in Section-3. while the conclusions of the work are presented in Section-4.

II. Proposed Dynamic System

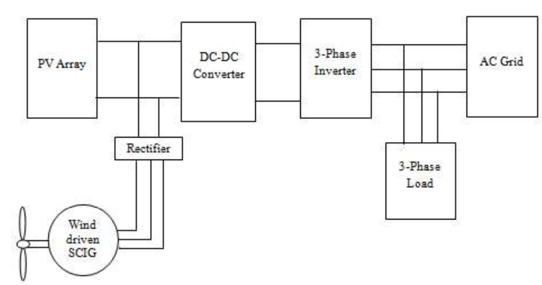

Fig. 2 Block Diagram of Photovoltaic-Wind Hybrid System

The block diagram of hybrid energy system comprising of solar PV array and wind system is shown in Fig.2. Whenever fault occurs at Point of Common Coupling (PCC), it reflects on output power as well as grid power. Therefore, a custom device named DPFC is used to enhance the power quality issues appeared at the load. In this paper in order to control the converters of DPFC Fuzzy Logic Controller and Genetic Based Fuzzy Logic Controllers are used.

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Distributed power flow controller based on fuzzy-logic controller for solar-wind energy hybrid system

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ABSTRACT

The demand of electricity globally led to the concept of renewable energy resources for power generation that are eco-friendly and freely available from nature. The solar photovoltaic systems and wind-based power generators are considered as primary renewable resources and are called as Distributed Generation units as they are scattered in nature. These are operated with bidirectional converters by providing auxiliary services at grid side and load side in either mode of microgrid operation. Besides, the DC power generation units' integration gets converted into AC system by means of inverters. These types of systems not only increase voltage and current harmonics, power frequency deviations but also drive the distribution system to risky operating zone. This emphasizes the stipulation of advanced control schemes for microgrid architecture. Consequently, power electronic converters introduce harmonics in the system and affect the system performance. To report these expanded issues, the authors recognized an advanced custom power device entitled distributed power flow controller. The proposed hybrid solar-wind energy system is first studied with a distributed power-flow controller. Later the system is examined by replacing proportional integral controller with fuzzy logic controller (FLC) for shunt control of distributed power-flow controller. To validate the investigations, MATLAB/Simulink software is used.

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1. INTRODUCTION

The swift escalation of power electronic equipment and its appliance have vividly altered the distinctiveness in the distribution system. The redundant serious power-quality problems are created in recent distribution system due to power electronic device based nonlinear components. Fascinatingly, it is renowned that the same power electronic devices have the capability to shield utility grid and load either from power quality problems. The flexible AC transmission system (FACTS) device and custom power device (CPD) are considered as the vital compensation devices to be installed in power system for finest control of active and reactive power flow [1]. The development of the FACTS has allowed for the implementation of various novel ideas that are making the power system more dependable, flexible, and providing greater control over power flow without affecting the generating schedule.

In an effort to optimize the performance of the power system network, the authors of this research suggest an unique device termed as distributed-power flow controller (DPFC), which is an improved version of the unified power flow controller (UPFC). The primary distinction between DPFC and UPFC is the lack of

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A Review on Diminution of Power Quality Issues in a Microgrid Using Various Facts Devices

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ABSTRACT
Renewable Energy Sources see opportunities in fulfilling rising demand with excellent power quality and dependability. As a result, the notion of micro-grid has emerged, with ubiquitous power providing generation units known as distribution generation units. A Microgrid can operate autonomously or with public grid connectivity. In the distributed power system, power quality problems start when the number of nonlinear loads and power-electronic distribution generation systems grows. This study conducts a few researches to improve power quality concerns utilizing FACTS devices.

Keywords- Electromagnetic interference, Flexible AC transmission system controllers, Microgrid, Power quality issues, Renewable Energy Sources,

INTRODUCTION

Power quality problems include brief disturbances in the form of transients, voltage dips and spikes, harmonic distortion, and flickering lights. The aim of designing electrical power grid is to deliver and maximize availability of reliable power for the customers [1-4]. Voltage transients, occurrence of harmonics from resonance and power semiconductor devices, Electromagnetic Interference, Communication failures, Inrush and circulating currents, faults such as voltage unbalance in bipolar DC bus are considered to be the most occurring power quality problems in a micro-grid. All these non-linear loads result in voltage distortion. Distributed Generation (DG) units not only provide clean power to critical loads without any distortions originating in the grid but also affirm energy supply to critical loads during continued disruptions as backup device [5-11]. The disturbances originated from the grid can be isolated from the loads using proper interface devices such as Flexible A.C Transmission System (FACTS) devices [12-15]. The FACTS technology incorporates power electronic controlled storage devices installed on the transmission side improvising power transfer capability and maintaining power flow over designated routes [14].

MITIGATION OF POWER QUALITY ISSUES USING FACTS DEVICES

The grid stability is crucial due to alternative usage of conventional power generation sources and there by these FACTS devices perform a vital role [7-9]. The following Fig. 1 shows FACTS controllers classification.

Arduino Based Metal Detector for Military Security

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ABSTRACT

The world's biggest and fastest-growing manufacturing sector is the electronic industry. Metal detectors are an electrical instrument that fascinates people. When properly designed and deployed, the world will be able to identify any metallic substance travelling by or approaching in close proximity. As an alert, this function would act as a security check for hazardous metallic stuff. Without the addition of a metal detector, no security system will be optimal or complete. A metal detector included within the gadget may detect metal items such as coins, nails, keys, and gold. This metal detector can identify some types of metal, particularly iron-containing metals (ferrous metal), even if they are hidden behind a half-inch of dry well or sand. The goal of this project is to design, create, and build a simple, inexpensive, and effective metal detector. The oscillator was used to build this metal detector. The primary goal of this project is to create a metal detector using electrical components that are readily accessible and inexpensive. Following the first and second world wars, one of the earliest widespread applications of metal detectors was the identification of land mines and unexploded bombs in a number of nations. This project provides an overview of the operating principle and uses of metal detectors.

Keywords- Arduino board, Buzzer, Diode, Power supply unit, Proximity sensor, Resistors

INTRODUCTION

We have experience working with a diverse assortment of materials, including metals and non-metals, among others. Examples of non-metal materials include things like plastic, wood, and several other non-metallic substances that we are already acquainted with. Ferrous metals and non-ferrous metals are the two types of metals that are distinguished by their magnetic properties [1]. In day-to-day life, metals are often used as power carriers, cooking utensils, and jewellery materials. They are also utilised for a variety of purposes in the military, including serving as the primary component of protective equipment such as mines. In the military, mines are commonly buried under the surface of the soil in a manner that will cause them to explode in the event that they are stomped on for an extended period of time. Mines include a variety of explosives, each with its own unique set of physical and chemical properties [2, 3]. It is not feasible to detect whether or not there are mines buried under the earth if one does not have access to any equipment. One of the pieces of equipment that is used in the process of determining the existence of mines is a metal detector [4]. Metal detectors make use of something called a "transmitter coil," which is a wire coil. As electrical current flows through the coil, it creates a magnetic field that surrounds the coil. When metal detectors are lifted off the ground, there will be a change in the magnetic field. When a magnetic field is maintained in close proximity to a piece of metal, the field has an effect on the atoms contained inside the metal and may even alter the flow of electrons. Users of this metal detector are at a considerable increased risk of becoming victims due to the fact that its operation still requires direct engagement from humans. Ease of executing a work is now a human requirement in carrying out its operations, allowing people to make technological breakthroughs. Technology is used to save time and money. One way to address these demands is to use robots technology, which may assist in the replacement of certain parts of human labor [5]. Of course, the employment of robots as a tool is created to be as near to what humans doing as feasible. Some robots are

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Design and Analysis of Flying Capacitor Multilevel Matrix Converter for aDFIG Machine based Wind System

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Abstract—**People all around the globe are in desperate need of finding new sources of energy to provide them with the energy they need to survive. As the world's require for electrical energy increases, the world's fossil fuel supply will be worn-out within several years, according to the International Energy Agency.As a result, energy sources that are alternate or renewable must be created to fulfill future energy demands. Grid-connected wind capacity is growing at the quickest pace of any kind of renewable energy production, with worldwide 20–30 percent yearly growth rates are expected. Power electronic converters are important components of wind energy conversion systems because they regulate and condition the output power from wind energy. In recent years, there has been a lot of interest in matrix converters and multilevel converter topologies. This paper coverts the Flying Capacitor Multilevel Matrix Converter design inWind Energy Conversion System employingDoubly-Fed Induction Generator. The performance of converter is analyzed using the MATLAB/SIMULINK software.**

Keywords—DFIG Machine, Flying Capacitor Multilevel Matrix Converters, Grid,Matrix-Converter, SVPWM,Wind Turbine.

I. INTRODUCTION

Energy is a critical component of our everyday actions. As population increases, fossil fuel use falls, necessitating the consumption of more natural resources to satisfy the demand. Wind energy, more than any other renewable energy source, contributes to the transmission of information. It is significant because it has enormous potential in terms of giving power to people all over the globe. Wind energy, in contrast to other energy sources, does not involve the use of fuel in the manufacturing process; instead, it harnesses the power of the wind to create electricity. Energy costs may be reduced by using a renewable source like wind, which doesn't need to be transported or mined.

There are various advantages to using wind energy. Wind energy is indigenous to the region, and landowners and small enterprises may set up single turbines or clusters of turbines on their properties. It does not release toxins into lakes and streams, and it does not release dangerous airborne pollutants into the surrounding environment. Wind energy does not contribute to acid rain or global climate change, as is often believed. The majority of other forms of energy, such as coal and natural gas, contribute to the emission of carbon dioxide, Wind energy, on the other hand, emits none. Wind energyis also environmentally friendly.

The utilization of wind energy has a minor influence on agricultural output and cattle grazing since wind farms only cover a tiny percentage of the land area under cultivation. A wind energy conversion system typically consists of the following basic components: wind turbine, wind generator, connecting devices, and control systems. Vertical-axis and horizontal-axis wind turbines are distinguished by the orientation of their rotor blades during rotation.Wind turbines of the 21st century are HAWTs with two or three blades, and they are capable of functioning in either a downwind or an upwind position depending on the wind conditions. This HAWT can be built for either constant speed or variable speed operation, depending on the requirements of the given application. The more efficient variable speed wind turbine is also less stressful mechanically and noisier than the other type. However, in order to maintain a fixed frequency and constant power factor [1] variable speed turbines must be accompanied by complex power converters and control systems.

In recent years,according to the International Wind Energy Association, most of the variable-speed wind turbines in WECS are operated by Double - Fed Induction

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Arduino Based Metal Detector for Military Security

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ABSTRACT

The world's biggest and fastest-growing manufacturing sector is the electronic industry. Metal detectors are an electrical instrument that fascinates people. When properly designed and deployed, the world will be able to identify any metallic substance travelling by or approaching in close proximity. As an alert, this function would act as a security check for hazardous metallic stuff. Without the addition of a metal detector, no security system will be optimal or complete. A metal detector included within the gadget may detect metal items such as coins, nails, keys, and gold. This metal detector can identify some types of metal, particularly iron-containing metals (ferrous metal), even if they are hidden behind a half-inch of dry well or sand. The goal of this project is to design, create, and build a simple, inexpensive, and effective metal detector. The oscillator was used to build this metal detector. The primary goal of this project is to create a metal detector using electrical components that are readily accessible and inexpensive. Following the first and second world wars, one of the earliest widespread applications of metal detectors was the identification of land mines and unexploded bombs in a number of nations. This project provides an overview of the operating principle and uses of metal detectors.

Keywords- Arduino board, Buzzer, Diode, Power supply unit, Proximity sensor, Resistors

INTRODUCTION

We have experience working with a diverse assortment of materials, including metals and non-metals, among others. Examples of non-metal materials include things like plastic, wood, and several other non-metallic substances that we are already acquainted with. Ferrous metals and non-ferrous metals are the two types of metals that are distinguished by their magnetic properties [1]. In day-to-day life, metals are often used as power carriers, cooking utensils, and jewellery materials. They are also utilised for a variety of purposes in the military, including serving as the primary component of protective equipment such as mines. In the military, mines are commonly buried under the surface of the soil in a manner that will cause them to explode in the event that they are stomped on for an extended period of time. Mines include a variety of explosives, each with its own unique set of physical and chemical properties [2, 3]. It is not feasible to detect whether or not there are mines buried under the earth if one does not have access to any equipment. One of the pieces of equipment that is used in the process of determining the existence of mines is a metal detector [4]. Metal detectors make use of something called a "transmitter coil," which is a wire coil. As electrical current flows through the coil, it creates a magnetic field that surrounds the coil. When metal detectors are lifted off the ground, there will be a change in the magnetic field. When a magnetic field is maintained in close proximity to a piece of metal, the field has an effect on the atoms contained inside the metal and may even alter the flow of electrons. Users of this metal detector are at a considerable increased risk of becoming victims due to the fact that its operation still requires direct engagement from humans. Ease of executing a work is now a human requirement in carrying out its operations, allowing people to make technological breakthroughs. Technology is used to save time and money. One way to address these demands is to use robots technology, which may assist in the replacement of certain parts of human labor [5]. Of course, the employment of robots as a tool is created to be as near to what humans doing as feasible. Some robots are

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Y Indira Priya Darshini ; Karanam Deepak ; U Chaithanya ; Y Hazarathaiah ; D Vannurappa ; Dr. Siva Ganesh Malla **All Authors**

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The voltage control of a wind energy based hybrid standalone Microgrid subjected to the faults on distribution feeders is presented in this paper. The effects of faults on the Microgrid are analyzed and required control measures are implemented to stabilize the turbine speed as well as to improve the quality of voltage at AC load bus. The controller of the existing maximum power point tracker (MPPT) is modified to limit the turbine speed during the fault(s). Distribution static shunt compensator (DSTATCOM) is further considered at AC load bus to provide the support for stabilizing the voltage during faults. Its novel control is presented to maintain the PCC voltages within allowable limits after occurrence of fault. Moreover, the connected DSTATCOM can also compensate for the reactive power demanded by the load. Further, with the help of DSTATCOM, torque pulsations induced in the generator due to unbalanced load are reduced. Fuel Cell and Electrolyzer are incorporated into the system to supply the reliable power at the load bus. The performance of Fuel Cell and Electrolyzer is also evaluated under the condition of fault. Extensive results based on case studies are presented in this paper with the help of MATLAB/SIMULINK package. The performances of proposed controllers are examined under unbalanced load as well as under different faults to show the satisfactory responses.

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Fuzzy Logic-Based Pitch Angle Control for VariableSpeed Wind Systems

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***Abstract*—In this paper, a sophisticated control approach for variable-speed wind turbine systems based on fuzzy logic is devised. Power and rotational speed at the generator's output is used as input variables by the fuzzy logic controller (FLC).The FLC is responsible for generating the rotor position standard, which can correct for the pitch angle's nonlinear relationship to wind speed. The influencing factors for the engine's production strength and torque are utilized to smoothly govern the wind turbine so that the aerodynamic energy itself and in high-wind regions, velocity is maintained at the power ratings with little fluctuation.The method has been seen via utilizing simulated results for a windmill system with a 2.0-Megawatt perpetual synchronous motor.**

***Keywords*—Probabilistic Reasoning Controller, Pitch Angle Control, Perpetual Synchronous Machine, Windmill.**

I. Introduction

Due to the power crisis and environmental concerns, renewable energy, especially wind energy, has recently received a lot of attention. The effect that wind turbine systems have on the consistency of the frequency and voltage is becoming increasingly important as wind energy's integration into the electrical grid is substantially expanded. Consequently, from the perspective of grid integration, the power regulation method used by wind turbines is also becoming more significant. [1]

Depending on wind velocity, highly variable speed, varying wind turbine systems consist of two operating zones. In the partial-load area, when wind speeds are less than the rated-wind speed$\mathbf{V}_{rated}$, the turbine is kept spinning at an optimum speed, in order to capture the most energy from the wind turbine. Since the capacity of the generator and converter is constrained, In the filled zone, when the wind velocity exceeds its rated capacity, the output power of the generator is maintained at its rated value. On the other hand, the pitch regulation can be applied to the partial-load zone to smooth output power.[2]

Several methods of regulating the wind turbine's pitch angle have been developed for reducing the amount of kinetic energy it absorbs in high-wind conditions.Commonly used pitch angle controllers have been those based on proportional-integral (PI) or proportional-integral-derivative (PID) to regulate power. Whereas a generalized linear windmill model obtained by tiny analysis is used in the control system,The approach has the disadvantage that the effectiveness suffers if the operational points are changed. This is the method's primary downside.Alternately, a method was presented that provides great results of the turbine's electrical output in addition to resistance to wind speed and turbine characteristics fluctuations. But because the constraints need the weighting functions to change, the model's and the controller's parameters must also be adjusted.[3]

The linear quadratic Gaussian (LQG) approach has been utilized with regard to the planning of the rotor position management. In reference to the phase tolerances and increase margins, respectively, the LQG controller has earned a stellar reputation for its dependability. Furthermore, due to the large nonlinearities shown by the wind turbines, the efficacy of such a linear controller is greatly limited.[4]

A rotor position controller using the approach of generic control scheme has been suggested as a possible solution for a broad operating range of wind speed. By minimizing the performance index, this strategy minimizes the control signal error at each interval and eliminates its divergence.

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Small Signal Analysis of Photovoltaic based Water-Pumping System Driven by Induction Motor

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Abstract:
Photovoltaic (PV) operated water pumping systems driven by induction motors are becoming popular in many places. The system consists of without using any storage device can make the system less expensive. However, proper energy management through an effective control technique is required to managing power balance in the system. In order to analyze the system, a small signal analysis is required to achieve the better parameters of controllers used in the system. The nonlinear model of the PV based water pumping system driven by induction motor with the help of vector controller is transferred to linear model to analyze the dynamic behavior of the system. In order to control the PV terminal voltage and speed of the motor, two PI controllers are used and designing of the parameters of the controllers is discussed in this paper through the transfer function obtained from the linear model. The response of small signal function is presented in this paper with the help of MATLAB under changing of reference dc-link voltage. Apart from this, complete mathematical analysis is included step by step for better analysis purpose.

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