A SCHEMATIC DESIGN OF DYNAMIC VOLTAGE RESTORER FOR UNBALANCED AND HARMONIC DISTORTED GRID

G. Prem Kumar Reddy
M. Tech Jawaharlal Nehru Technological University, Ananthapur, Andhra Pradesh.
Associate Professor
Mahaveer institute of Science and Technology, Hyderabad

Abstract:

Generally, the non-conventional strength sources are being substantially used in case of strength electronic converter based totally distribution systems. This paper specially specializes in the wind energy machine integrating with grid connected device and additionally development of energy fine features. The wind power electricity plant is modelled based on associated equations. For improving these strength exceptional problems, this paper proposes the ideas of shunt converter controllers. This paper prolonged with PQ-idea controller primarily based STATCOM to enhance the modern-day harmonic distrotions. And additionally the results are as compared for these cases. Thus with this type of manage, a balanced load currents are obtained even inside the presence of non-linear load. The experimental setup is finished in Matlab and validated the simulation effects

Keywords — DVR distributed generated system (DG), distribution system and renewable energy.

Introduction

Generally, with growth inside the energy demand because of growth in populace, usage, the Generation of power turned into sincerely a project now a day. Due to excessive utilization of non-traditional strength assets as a one of the distribution electricity source, may also reasons the steadiness troubles which includes voltage law and other energy nice problems. Therefore, the strength digital primarily based compelled commutated converters are desired in distribution system for maintaining the system stability, reliable performance and green paintings and also development of reliability of energy at p.C.

The present day distortions in non-linear load may also give up end result same distortions inside the machine voltages and in some cases additionally suggests the acute impact on energy machine. Generally, these problems in electricity device are greater complex and also have face the problems for identifying the trouble in case of grid interconnection of wind electricity machine. If this troubles non-stop, it’s particularly motives the damage of system and additionally reduces the system performance. The development of power first-rate is acquired with the resource of controlling the transmission parameters which includes significance of the device voltage, line impedance and cargo mindset. Depending at the control capability and connection of the compensating tool to the device, the ones converters are categorised into techniques known as as shunt and collection converters.

A shunt device is a compensating device i.E. That is connected between the grid linked point referred to as as PCC and the ground. Shunt converter has the functionality of either generate or soak up reactive power at the factor of connection. Because the bus voltage significance can handiest be various inside certain limits, controlling the power flow on this way is restrained and shunt gadgets mainly serve other functions.

Figure 1 shows the basic diagram for the shunt connected inverter based grid connected system.
Fig. 1. Basic schematic diagram for the proposed renewable energy system.

Grid Interconnection of Wind Energy System

Recently grid connected wind systems were spreading in residential regions and in business areas. So we have to find an appropriate MPPT method that gives a higher strength output while connected is to discover. For a grid linked system there are sure elements which have been taken into consideration such that DC-AC conversion with highest output strength exceptional with the proper design of filters System foremost controlling elements like MPPT. Grid interface inverters which transfer the energy from the wind power era machine to the grid thru keeping constant of dc link voltage. For a grid associated machine the utility community in particular needs for better power high-quality and energy output. In the case of voltage fluctuations manipulate of grid parameters is very difficult. So for a wind gadget this is linked to a grid first degree is the boosting stage and the second one level is DC-AC converter. An output clear out is commonly employed which reduces the ripple additives due to switching problems. The trouble associated with the grid related system is that the dc link voltage that must be oscillates a few of the ranges which is based upon the operating climatic situations (ambient temperature & irradiance) wherein inverter which acts us a electricity controller between the dc hyperlink and the software. Dc hyperlink is commonly used to isolate among the grid aspect and the inverter side just so we can control both wind device and grid one by one. All the to be had strength that may be extracted from the wind system is transferred thru the grid.

Wind Energy System

The generation of electrical electricity is obtained specially in two ways i.e. one is conventional supply and different is non-traditional strength sources. The technology of power the usage of non-renewable sources including coal, natural gasoline, oil and so on, shows excellent effect on the environment by manufacturing of pollution from their widespread gases. Hence, with the aid of thinking about some of these conditions the era of energy is acquired from the renewable strength sources.

Basically, out of all renewable power assets the wind turbine performs an essential position for generating electricity. And also from cost effective factor of view the wind turbine has low maintainance price as it needs no fuel so that it's far pollutants free. Mostly, in present world 50-60 percent of strength is generated from wind turbine compared with all different renewable energy assets.

The typical layout of wind power generation as shown below.

Fig. 2. Basic schematic diagram of wind turbine.

The wind turbine converters wind energy to electrical energy and the generator mechanical shaft power is obtained by the following expression:

\[ P_m = 0.5 \rho AC_p v^3 \]

And the coefficient of strength also performs a key position for wind machine and the fundamental minimal cost of energy coefficient is zero. Five. The power coefficient is acquired by using the ratio of tip velocity ratio to pitch perspective. The pitch...
perspective is the attitude is used for aligning the turbine blades with respect to its longitudinal axis and converting of wind course. The tip pace ration is defined as ratio of linear pace of the rotor to the wind pace.

Fig.3 shows an ordinary waveform for coefficient of energy with admire to the top speed ratio. The most attainable range of TSR is from zero. Four to 0. Five for turbine with excessive pace and from 0.2 t0 0.4 for turbine with low speed.

**Operation of Dynamic Voltage Regulator**

In order to defend the strength device additives from the overall fault conditions which includes voltage sags, the dynamic voltage restorer plays a key function compared with the alternative compensating strategies. And also the efficiency of for this converter is high and offer dependable operation.

The dynamic voltage restorer is a one of the type in collection converter of statistics devices. The primary characteristic of this collection converter is to inject more voltage to the transmission system for regulating the voltage across load. The region of dynamic voltage restorer is usually located in distribution aspect i.E. Among distribution feeder and load. The schematic diagram of the dynamic voltage restorer is shown in determine four. And the primary components used for constructing the dynamic voltage restorer are indexed beneath.

The popular configuration of the DVR is specially includes the following components including,

i. An boosting transformer  
ii. A filter out for lowering harmonic  
iii. The battery power Storage device  
iv. A Voltage Source Converter  
v. DC charging circuit  
vi. A manipulate diagram for controlling DVR based on reference voltages and actual load voltages with the help of PWM method. In this a trendy PI controller is used for controlling the error value.

![Impedance Diagram](image)

**Fig.3. Power coefficient Vs Tip Speed Ratio**

**Fig.4 basic structure of dynamic voltage restorer.**

The aim of dynamic voltage restorer is used for compensate the changes in voltage dynamically. The voltage generated by way of a pressured commutated converter is to inject the road thru a chain transformer referred to as as boosting transformer.

The simple operation of dynamic voltage restorer may be explained in specially three modes which include: one is safety mode, 2d one is standby mode, and 1/3 one is injection/boosting mode.

1. **Protection mode:** if in any state of affairs the load current is improved more than its permissible price, because of fault situation or quick circuit on load aspect, the dynamic voltage regulator may be isolated from the by the use of bypassing switches S1 and S2.

2. **Standby Mode:** (VDVR= 0): in case of this standby mode the boosting transformer secondary winding is short circuited, with this the DVR is not able to inject any compensating values.

Three. **Injection/Boost Mode:** (VDVR>zero): In this case of injection mode the transformer known as as injection transformer, the DVR have the
functionality of injecting voltage for compensating
the strength first-class problems.

**In-phase reimbursement technique for dynamic
voltage restorer**

This In-segment compensation approach is the
clear-cut technique. This in phase technique
provides that the injected voltage is maintained in
phase with the deliver voltage irrespective of the
load current and pre-fault situations. Generally, the
phase angles among the pre-sag and load voltages
are exceptional but additionally it has the capability
of keeping the strength excellent with the aid of
compensating the weight voltage.

**Fig.5. In-phase compensation method**

The most important function of dynamic voltage
restorer is to protect the sensitive load on purchaser
aspect and energy gadget additives for the duration
of fault situations. The vicinity of DVR is
diagnosed based totally at the touchy masses. If a
fault occurs at the transmission line, then the DVR
located in series with the transmission line. If there
is any presence of fault within the transmission
gadget, then it reasons the changes in load voltage.
Due to this modification the weight can be affected.
So, for compensating this trouble the dynamic
voltage restorer injects the extra voltage thru the
energy digital converter which is anti-section
voltage to the voltage in the course of fault. The
fundamental controlling diagram for generating
suitable pulses to three section converter is as
shown in figure 5.

**Fig.6. Block Diagram of General DVR Circuit**

Basically, the 3 phase load voltages are converted
to the 2 phase rotating reference body the usage of
parks transformation method. And additionally the
source voltage at the factor of commonplace
coupling is converter to direct and quadrature axis
components using parks transformation. These
supply and cargo voltages are compared and carried
out to PI controller. The error obtained is used for
generating gate firing alerts to the voltage supply
converter.

**Fig.7. Control Diagram for statcom converter**

**Simulation Study**

The simulation is done based on the fig 1, and it shows in figure 9 and the obtained power
quality is shown below simulation waveforms.
Finally, this paper proposes a novel concept of grid interfaced wind strength era gadget at the side of the DVR controller for enhancing system stability thereby stepped forward the reliability. This paper additionally indicates the concept of electricity first-rate problems and their problem effect on the client and electric powered utility structures are supplied. Therefore, distortions in currents are eliminated and maintained voltage and modern-day are in equal section for enhancing energy factor so that and reactive strength demand for the wind generator and cargo at PCC in the grid system. Hence, the integrated wind era and FACTS tool have proven the remarkable performance in keeping the PQ profile as in keeping with requirement. The operation of the DVR based grid related wind electricity machine were nearly advanced and implemented in Matlab/Simulink and determined the simulation outcomes. With this proposed PQ theory based statcom controller the THD is reduced to 2.03%.

REFERENCES


