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Loss Compensation In Distribution Line Using DSTATCOM

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Abstract

In the recent years electrical power transmission increases due to the demand of electrical energy mainly in developing countries. With the increasing size and complexity of the transmission networks importantly, the performance of the power systems decreases due to problems related to with power oscillations, voltage quality and load flow. High-voltage direct current (HVDC) and Flexible AC Transmission systems (FACTS) technologies offer some effective schemes to meet these demands. To remove identified networks, FACTS technology has been considered as one feasible planning. An attempt is made in this paper to discuss the development of FACTS, using SIMULINK is to carried out for comparing voltage regulation issues, improving total harmonic distortion (THD) with varying transmission line distances using Fuzzy logic control, and compares pi and fuzzy control results using SIMULINK.

Keywords: FACTS, Fuzzy logic, total harmonic distortion (THD) .

Introduction

The present power systems have a high rate of complexity and there is expansion in power transmission networks due to the increase in generation and loads and also due to the extensive interconnections due among various power utilities. The present AC poses following challenges.

1. To known about the Power flow in parallel paths is determined according to their reactance.
2. Stability considerations are limited in a AC lines.

3. Power flow in a AC lines much below the peak value it states lack of control in AC lines.
4. The dynamic reactive power control in a AC lines is to helps to maintain the satisfactory profile under varying load conditions.
5. Suppose the reactive power may be increase due to demand of load levels. In this time mismatch or instability in the voltage levels in the transmission lines may happens and it sometime it may goes to collapse the lines.

Flexible AC Transmission System(FACTS) is a concept that involves the application of High power Electronic controllers in AC transmission networks which enable fast and reliable control of power flows and voltages. FACTS technology is collection of high power electronic controllers, which can be applied individually or in coordination with others to control one or more of the interrelated parameters.(K. R. Padiyar et al,1997). The thyristor or high-power transistor is the basic element for a variety of high-power of electronic controllers. FACTS deals with:

1) Regulation of power flow in a prescribed transmission routes.
2) Secure loading lines near the power carried by an electrical power system that results from heating effects of the power carried by the devices.
3) Damping oscillations which can be threaten the security or limit the usable line capacity.

In power distribution networks reactive power compensation plays an important role in correcting power factor, improving power quality and maintaining constant distribution voltage. The concept of FACTS controller conveys that the Voltage Source Converter (VSC) is the basic block in the STATCOM. For a economic and performance reasons voltage-source converter is preferred to the current-source converter devices. One such VSC based controller called the distribution static compensator (DSTATCOM) proves to be a viable alternative to the conventional SVC.

Dynamic Hysteresis Switching Control

Dynamic Hysteresis Switching control is mainly used in the Voltage Source Inverter (VSI) Topology. In this topology we are using three-phase four-leg VSI. This topology helps to improve the switching operations. In this section we have to reduce the switching frequency up to 50%. The proposed system hysteresis control method is used in nonlinear loads for both balanced and unbalanced supply systems. Three Phase Supply voltages are named Vsa, Vsb and Vsc in unbalanced and distorted. The currents are Isa, Isb and Isc for nonlinear loads.

Different types of control strategies has been there [7]-[9]. But three-phase four-leg strategy is used in very high range of switching frequencies of power switches. Conventional hysteresis control strategy is mainly helps to track the reference currents. One of the control technique is a optimized control technique is used to reduce the switching frequency. The main drawback is the technique [6] does not work in unbalanced and distorted supply voltages. This control scheme uses a phase

sector detection that detects the switching operations in to six equal sectors based on phase angle of the supply voltages. In the proposed system hysteresis control is mainly used in nonlinear loads and both balanced and unbalanced supply voltages. And this scheme does not require any phase segment detection for defining for switching operations. The control scheme suggested is [6] in the special case of proposed scheme.

Predictive Current Control of A Voltage Source Inverter Existing System

Predictive current control is a method to predict the feature value of the load current generated by the inverter for all possible voltages. The predictive control method is used for both linear and non-linear loads. For linear method pi controller is used in the PWM, for non-linear loads hysteresis control method is used [1]-[3]. Predictive current control is a enormous concept it have different methods these methods are present in [4].

Predictive current control mainly uses to calculate the necessary load voltage to matches the current behavior. A modulator and converter is used to generate the voltage and current. These strategies is used in a inverter [5],[2] also for rectifiers and active filters [8]. Predictive control is used to reduce the switching frequency for high power inverters. And predictive control [10] is used to estimate the current error in each switching state.

Existing System

Energy conversion measures, the use of renewable sources are the main factors to meet sustainable energy to these days. The integration of wind energy into existing power system present a technical challenges and that requires a consideration of voltage regulation, stability, power quality problems. The power quality is a essential customer focused measure and is greatly affected by the operation of a distribution and transmission network. The power quality problem is the great importance to the wind turbine. There has been an extensive growth and quick development in the exploitation of wind energy now a days.

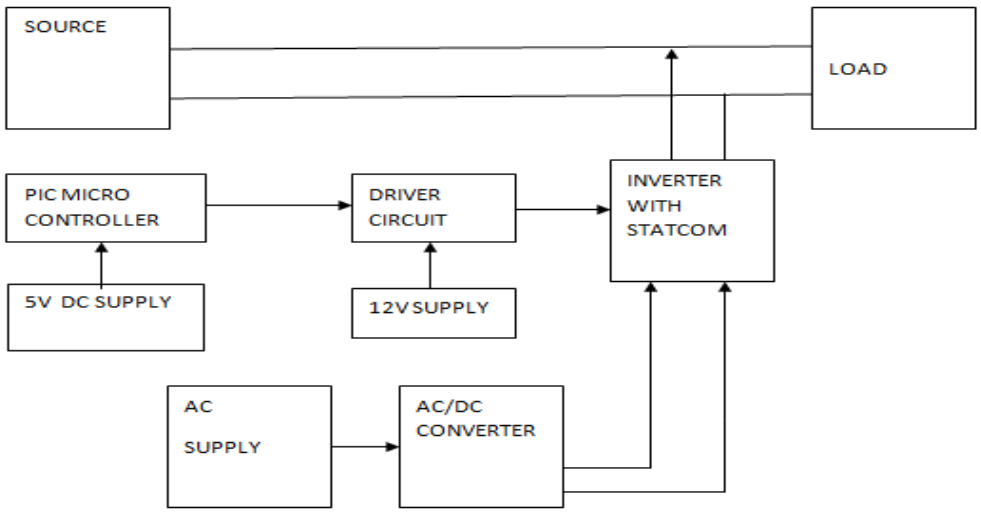


Figure 1: Block diagram of wind energy in existing system

A. Simulink Using Pi-Controller

Figure 2 shows SIMULINK using pi controller. In this IGBT act as DSTATCOM. Supply goes to the source to the load. Hysteresis control is given the gate pulses to the IGBT and one more advantage is that it reduces the switching frequency time up to 50%. Between source and load we should taken the feedback path and improves the THD value for nonlinear load equipments.

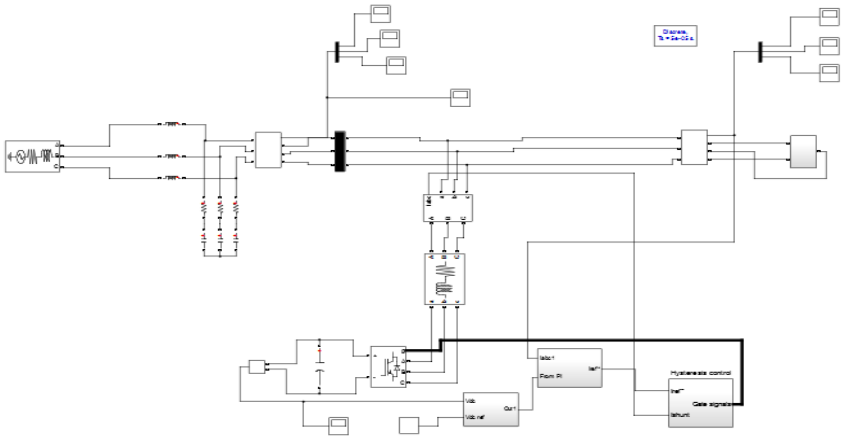


Figure 2: SIMULINK using pi-controller

B. Simulink Using Fuzzy Logic Controller

Figure 3 shows the SIMULINK using Fuzzy logic controller. Operation is like same as pi controller. But fuzzy system is acts like a rule based. Rules are must, to run the fuzzy programs.

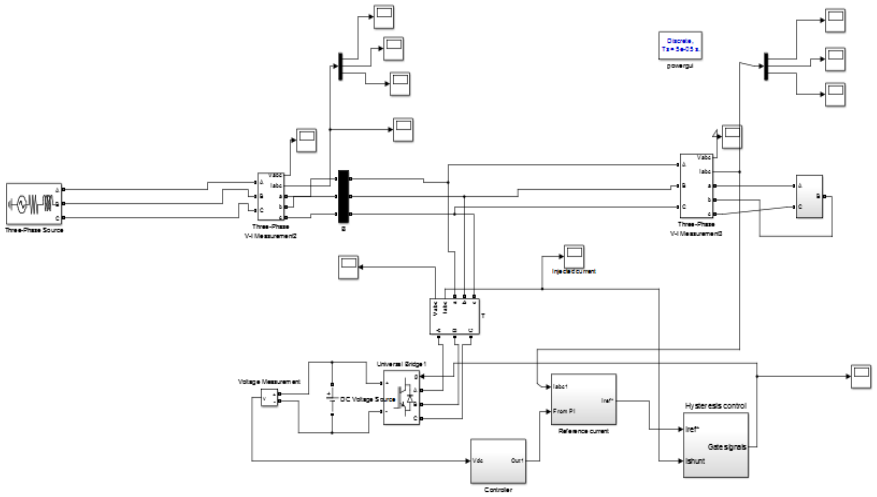


Figure 3: Simulink Using Fuzzy Logic

C. Hysteresis control

In order to improve the performance and life of the power switches of VSI, we require an optimized control technique that reduces its switching frequency. Proposed Hysteresis current control method is a generalized control method that minimizes switching operations to compensate non linear load under both balanced and unbalanced supply voltages. It is shown that this control scheme is able to reduce the switching frequency by more than 50% compare to conventional hysteresis current control method and retain the quality of load compensation.

Proposed System

This proposed system presents the control of distribution of a static synchronous compensation(DSTATCOM) is achieved using THD compensation. Switching of VSC or VSI is achieved by controlling source current to follow reference currents using hysteresis based PWM control. Here we can compare the results of STATCOM with pi controller and fuzzy controller with STATCOM circuits. Fig4. shows the proposed block diagram. It have Three phase inverter, Fuzzy based control technique.

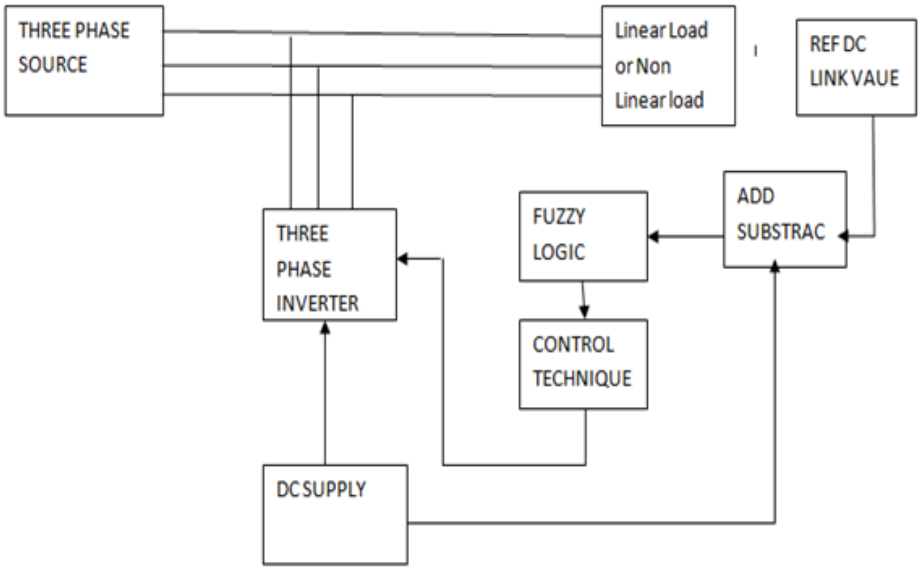


Figure 4: Block diagram of proposed system

Simulation Results

This section overviews the simulation result of a pi-controller and fuzzy logic based controller and compare these both results and observe the THD value what may changes occur. First we have to shows a pi-controller next we have to seen fuzzy based controller.

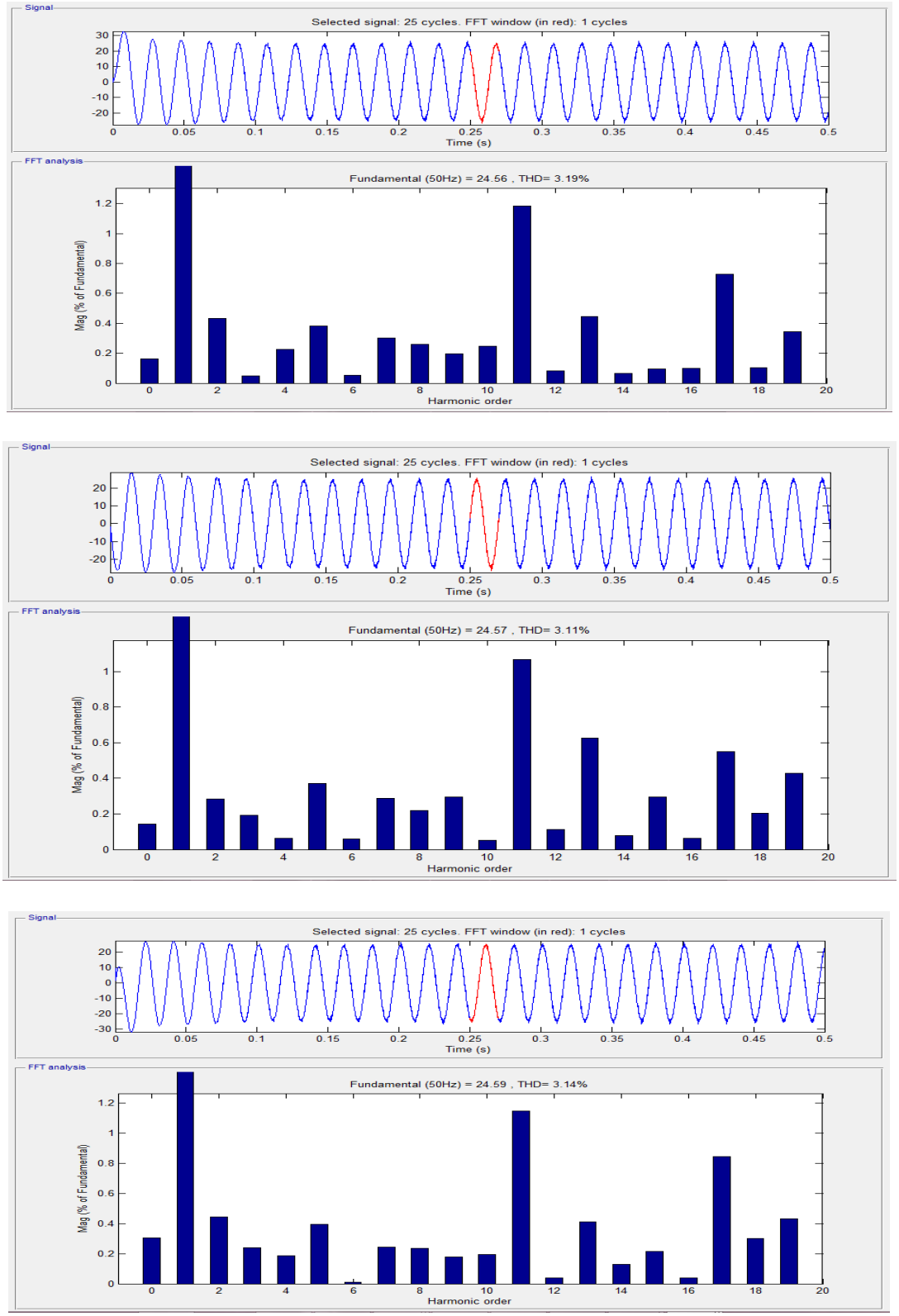


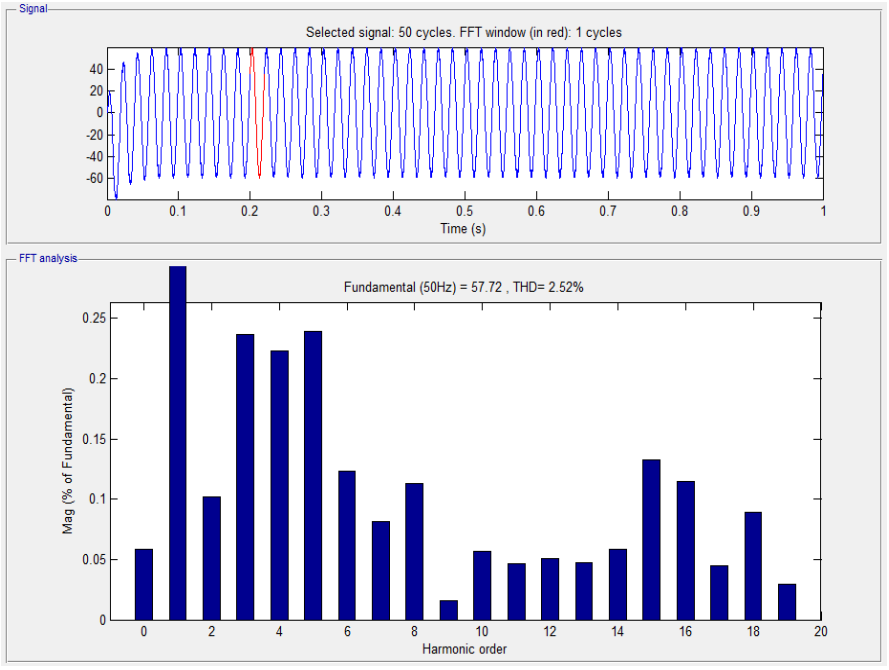
Figure 5: Simulink Result Using Pi-Controller For Three Phases A, B And C

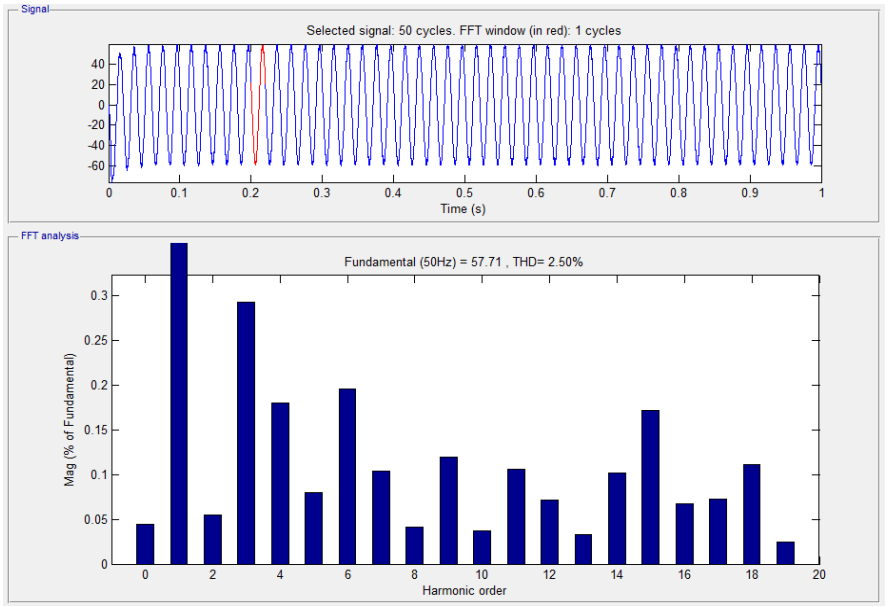
D. Proposed System Results For Pi Controller

SIMULINK result using pi-controller for all three phases are shown in fig.5. For all three phases THD value is displayed on figures. In X-axis acts Harmonic order and Y-axis acts Magnitude (% of Fundamental). First we have to run the program in SIMULINK the running time should be 0.5sec. It will take some time to run the program. After completion click the powergui next FFT analysis later on click the display option. Before select the display option we should run the isa means phase A. Normally it will selects a 25 cycles for each phase complete one cycle is shown in red mark. Starting the harmonic value is peak position and later it will decreases. For all three phases peak harmonic will touches at result 1. For three phases different THD values may occur, these three very nearer to each other but not the same value.

E. Proposed System Results For Fuzzy Logic Controller

For fuzzy logic controller simulation operation is same like pi-controller but small difference is we have to enter the fuzzy rules in simulation system. Firstly we should enter the fuzzy to the SIMULINK in the common window FIS editor is displayed. Click the file name and next click import right side the two options will be displayed to workspace and ctrl + O. Press ctrl + O on the keyboard next import the fuzzy rules. In the same way the rules should be export later on run the program. For fuzzy the run time should be 1sec. 50 cycles should be displayed in selected cycles. Finally THD value1s for all three phases are displayed.


Signal
Selected signal: 50 cycles. FFT window (in red): 1 cycles
Time (s)
FFT analysis
Fundamental (50Hz) = 57.72 , THD= 2.52%
Mag (% of Fundamental)
Harmonic order


Signal
Selected signal: 50 cycles. FFT window (in red): 1 cycles
Time (s)
FFT analysis
Fundamental (50Hz) = 57.71 , THD= 2.50%
Mag (% of Fundamental)
Harmonic order

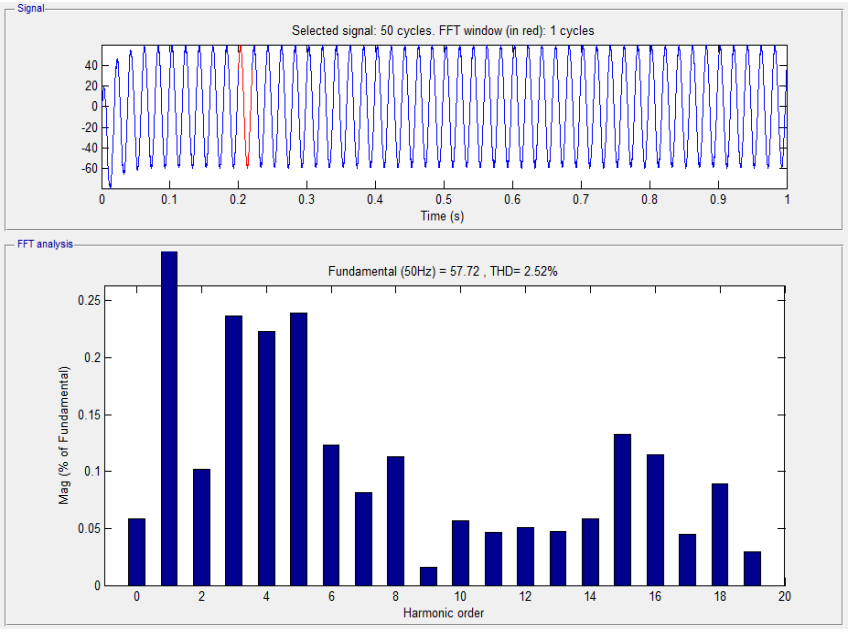


Figure 6: SIMULINK result using fuzzy logic controller for Three Phases A, B and C.

Figure 7: Tabular Column

Sl.NO.	**Comparing the results of pi and fuzzy logic controller using tabular column**	
	Fundamental(50Hz) for pi controller all the Three Phases	**THD value for PI controller**
1.	For Phase A 24.56 For Phase B 24.57 For Phase C 24.59	3.19% 3.11% 3.14%
	Fundamental(50Hz) for fuzzy logic controller all the Three Phases	**THD value for fuzzy logic controller**
2.	For Phase A 57.72 For Phase B 57.71 For Phase C 57.72	2.52% 2.50% 2.52%

Conclusion

Renewable energy sources like wind, solar and ocean energy system the output voltage and current can be varies due to the seasonal conditions. Non-renewable energy sources also facing the power quality problems. Power projects they spend lot of money to maintain the power quality problems. This project may help to maintain the power quality through out the line. This project main aim is reduce the THD value in a Transmission lines in AC. In this two methods of controlling systems be used to reduce the THD value for non-linear loads. Finally compare the both the results

choose the better one to reduce the THD value. Using fuzzy control it will reduce the THD value slightly more compares the pi-controller. One of the advantage of fuzzy controller is that reduce the cost of the equipment and it was a rule based system. In featue Fuzzy control developed in anormous in the world. Not in feature present also this project defenately helpful to the AC Transmisson lines.

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