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Power Quality Improvement In Distribution System Using Fuzzy Logic Controller Based Statcom

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Abstract

To the extent interest of power expanding, power generation from conventional and non- conventional sources likewise expanding. In this proposed work, four-unit system is made and an issue is presented for investigation. To oversee receptive power STATCOM is executed. The area to work with these conventional regulators is to improvement their presentation utilizing most recent innovations. Also, in this work overcurrent relay is advanced utilizing extra excursion component and STATCOM is streamlined its presentation utilizing Fuzzy logic controller (FLC). Parameters considered for this correlation is voltage, current, Total Harmonic Distortion (THD), dynamic power and receptive power. The proposed system is designed for analysis of overcurrent relay and STATCOM for micro grid system with four units. System that is designed in MATLAB/ Simulink is using fuzzy logic controller for optimization of reactive power and working of overcurrent relay in case of fault.

Keywords: Overcurrent relay, FACTS, STATCOM, Fuzzy Logic Controller, THD

Introduction

Electric energy is created by electrical energy source, which are important infrastructures whose service is important for a country's economy. Providing continuous supply of electrical energy to meet the demand of the load is a complex technical challenge. It involves real-time estimation of the system state in which the production units are controlled and coordinated, whose purpose is to provide electricity in a safe way. As a result, electricity transmission network security is a major concern throughout the world. However, due to the regulator, the power system is being operated near its maximum load capacity. Apart from this, environmental hurdles obstruct the expansion of power transmission network by meeting the development of future demand. As a result, there is more sensitivity to serious problems in electrical systems such as defects on the major pieces of equipment, due to such contingencies, there may be a cascading failure due to large scale blackout, and hence the new control plans are required. It has been learned that controlled separation system is a good solution to this problem.

Relay for Protection

Overcurrent protection

There are three distinct sorts of overcurrent-protection relay; Operating principles for short circuits, semantic-fault and over-burden each of the three applications depend on the examination of current as observed by relay and preset worth. Overcurrent protection is straightforward, shabby and solid. Despite the fact that it performs best in the spiral system in light of the fact that the determination system is difficult or now and then it is difficult to get in fake system setup.

STATCOM (Static Synchronous Compensator)

The first SVC with the voltage source converter, which was known as the situation in 1999, has the basic features of STATCOM in line with the synchronous condenser, but it is an electronic device and has no inertness, hence it is better than the synchronous condenser.

The reactive power is completely independent from the actual generated voltage at the connection point, this is the main advantage of STATCOM, due to which STATCOM maintains its full potential at the most critical contingencies, the use of voltage source converters for grid interconnection in today's distributed energy field is common.

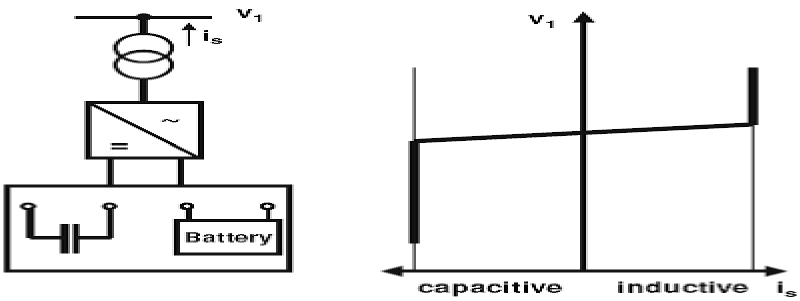

Fig.1: STATCOM Structure and Voltage / Current Characteristic

Simulation

Over current replay is designed for four generating sources. The system is controlled using relay and a STATCOM device for reactive power. Modeling of system is designed in MATLAB / Simulink. Voltage source of 735 mw each is implemented with 6 Bus system. Fault is applied offer relay at 0.04 Ts. Relay will operate offer fault occurs in the system and the result in the form of waveform and analysis is performed using controller of Fuzzy Logic at STATCOM terminals and represented in next chapter of thesis.

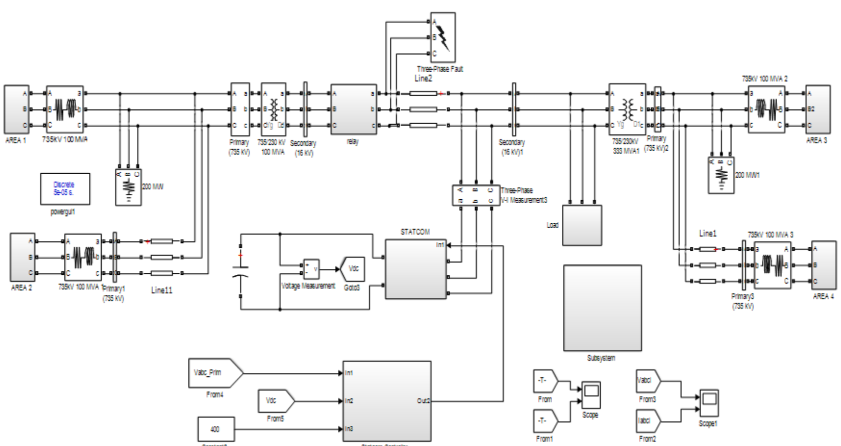

Fig. 2: MATLAB Model for proposed system.

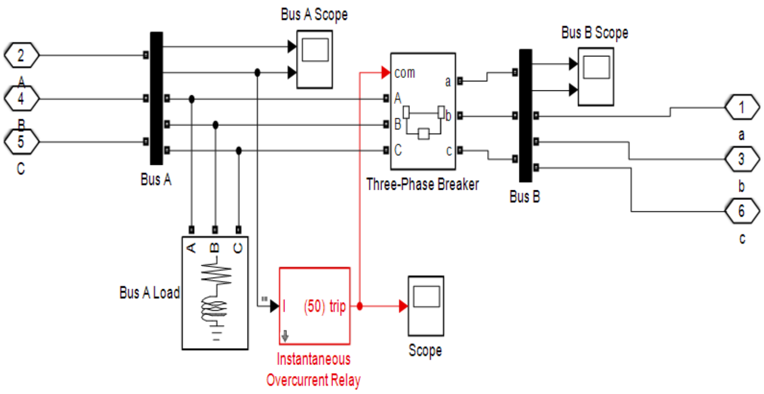

Fig. 3: MATLAB diagram of overcurrent relay in system.

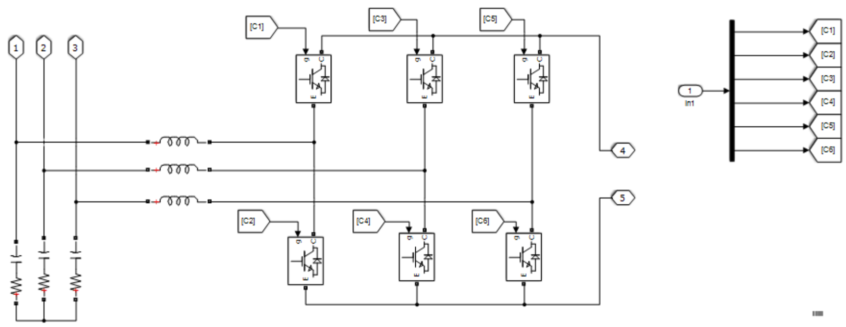

Fig 4: STATCOM Structure in MATLAB.

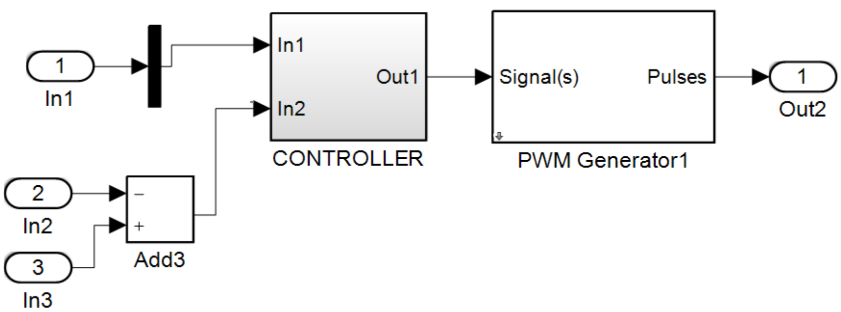

Fig. 5: MATLAB model for STATCOM Controller.

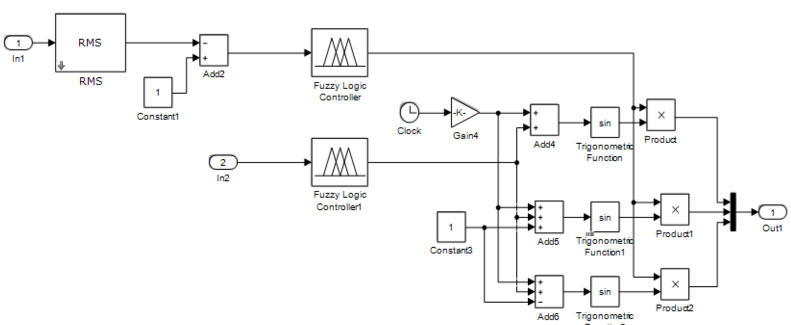

Fig. 6: STATCOM model with fuzzy logic Controller.

Results and Analysis

Power system is designed in MATLAB/Simulink software. Overcurrent relay is used to trip system in case of fault. Fault is injected in the system to analysis of parameter performance. STATCOM is connected to control reactive power in system and manage distortions. For better performance Fuzzy logic controllers (FLC) analysis is performed in the form of waveforms shown in this chapter. Overall results represent better performance of FLC with parameters as bus voltage and current, Total Harmonic Distortion (THD) and active & reactive powers in the system.

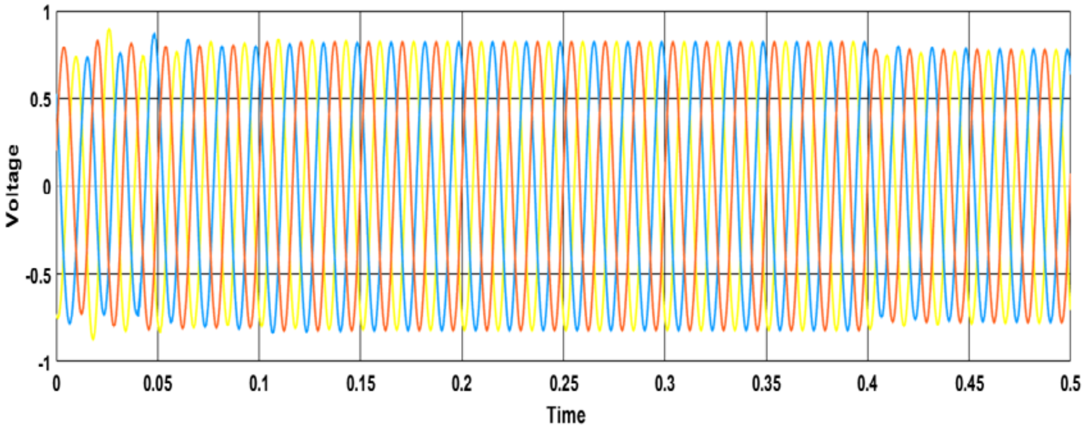

Fig. 7: Bus voltage before relay with FLC

Figure 7 Represented the Bus Voltage of Bus Before Relay with FLC. FLC used with STATCOM also Controls the Voltage Parameter in Power System.

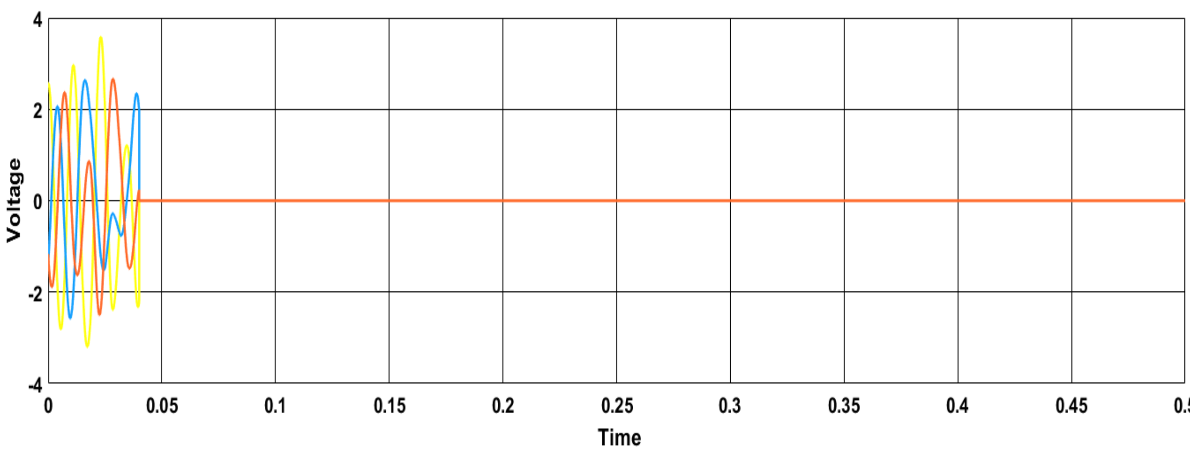

Fig. 8: Bus voltage after Relay with FLC

Figure 8 represented bus voltage of bus connected after relay with Fuzzy Logic Controller. This waveform shows the control of voltage and relay operation after fault condition. In FLC the voltage is completely cutoff as relay is in operating condition. Overcurrent relay operates at 0.05 μs in FLC.

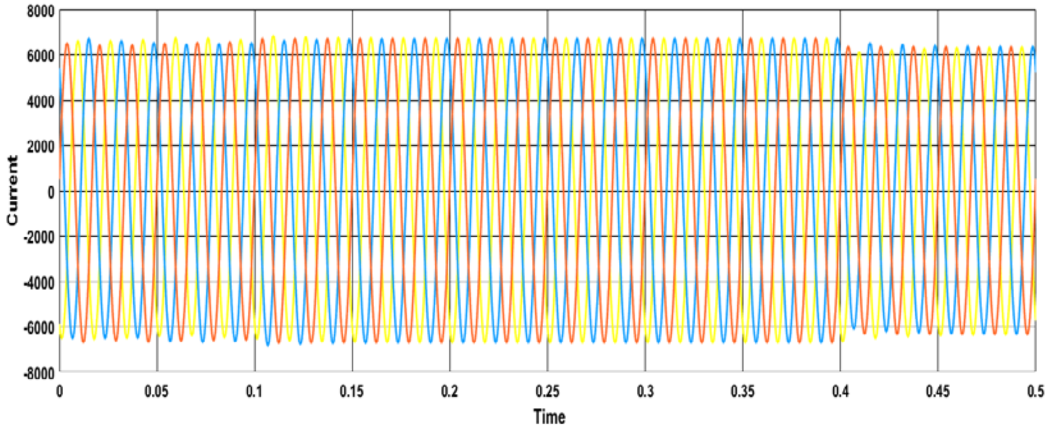

Fig. 9: Current in Bus before Relay with FLC

Figure 9: Shows current of bus connected before over current relay and fault FLC. This shows that in condition of FLC it will remain in normal condition as the fault occur after this bus.

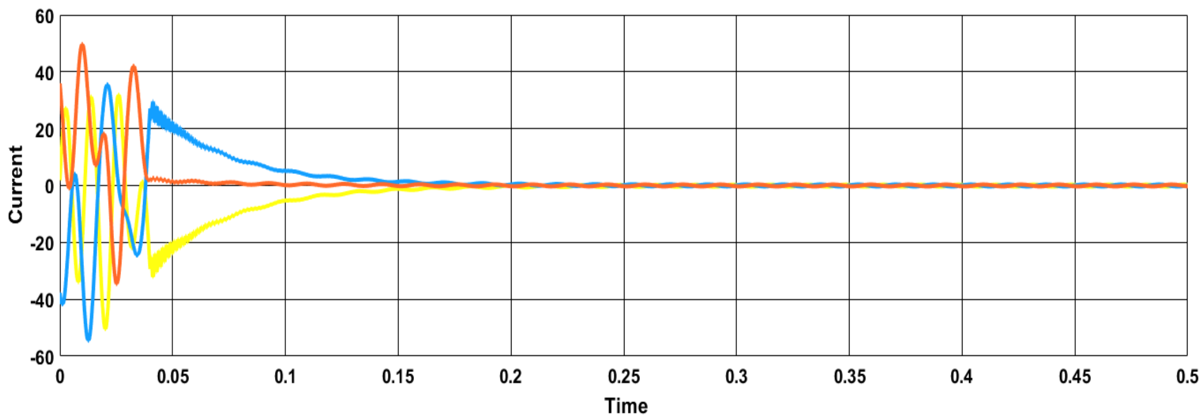

Fig.10: Bus Current after Relay in FLC

Working condition of bus current in case of FLC is represented in fig. 10. It shows that there is no leakage current in case of FLC, it is controlled.

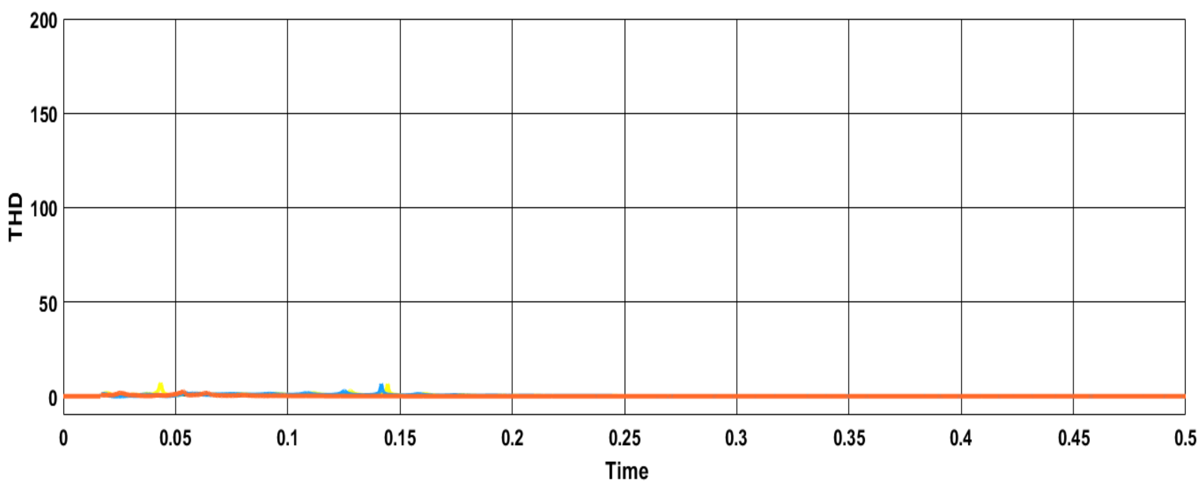

Fig. 11: THD in Bus Voltage before Relay in FLC

Total harmonics Distortions (THD) in bus voltage connected before and after relay with fault is shown in figure 11 & figure 12.

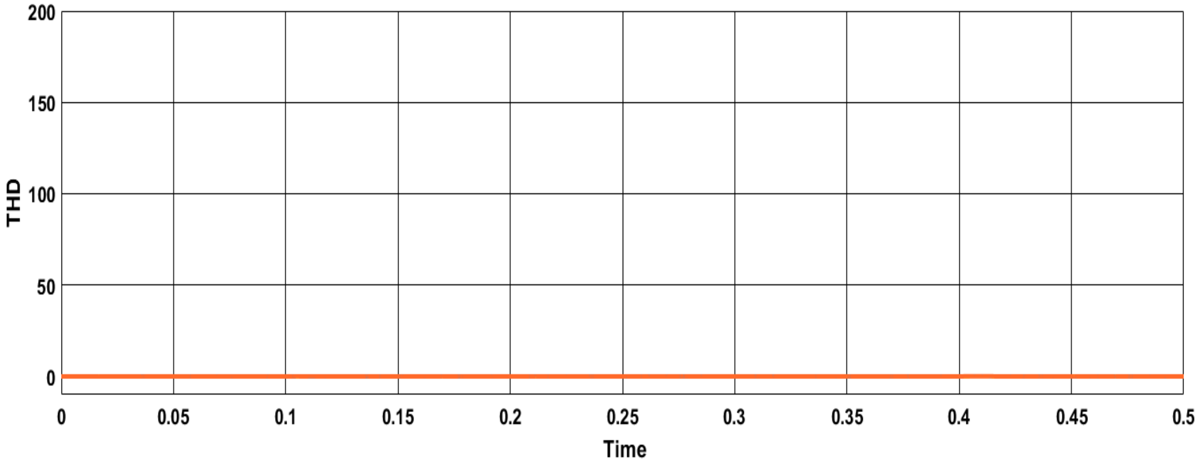

Fig. 12: THD in Bus Voltage after Relay in FLC

Conclusion

The proposed system is designed for analysis of overcurrent relay and STATCOM for micro grid system with four units. System that is designed in MATLAB/ Simulink is using fuzzy logic controller for optimization of reactive power and working of overcurrent relay in case of fault.

Overview of system is presented in chapter-4 with mathematical modelling and its analysis using FLC.

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