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Setting Analysis Of Over Current Relay And Statcom With Pi And Fuzzy Logic Controller For Thd Analysis

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Abstract
The electrical energy scenario is consistently changing every decade drifting more towards renewable energies then conventional thermal power generating stations. Short circuits and other symmetrical and asymmetrical defects are common in power systems. Over Current Relays (OCR) are the protective relays used for transformer protection. In this proposed work, we have concentrated on the analysis of instantaneous over current relay. Over current replay is designed for two generating sources. The system is controlled using a relay and a STATCOM device for reactive power. Modeling of system is designed in MATLAB / Simulink. Voltage source of 735 KV each is implemented. Fault is applied offer relay at 0.1 Second. Overcurrent Relay will operate offer fault occurs in the system and the result in the form of waveform and analysis is performed using PI controller and Fuzzy Logic Controller at STATCOM terminals.
Keywords: *Electrical energy, Voltage, system, STATCOM, FACTS Devices, Over Current Relay.*

I. Introduction

Any power network's protection should be set up so that protective relays quickly disconnect the compromised network component, reducing system disruption, avoiding equipment damage, and maintaining service to the network's healthy portion. When enough time has elapsed, backup relays take over if the primary relays fail [1-3]. The protective relay should be able to differentiate between normal, abnormal, and fault conditions. Relay coordination encompasses the concepts of backup protection, selectivity, and discrimination [4-6]. In the modern era, economically developing nations are seeing an acceleration in the growth of their electrical power consumption. Networks used by electricity companies thus grow incredibly complicated. The process of load flow analysis, fault calculations, and outlining primary and backup pairs will be time consuming, and several iterations will be required to calculate the TMS of relays in order to find the minimum threshold discrimination margin between a relay and all of its back-up relays in a large electrical system [17-18]. This is only possible through computer programming. ETAP conducts numerical computations with breakneck speed, applies industry-accepted standards automatically, and generates easy-to-understand output reports [7, 8].

The use of renewable energy (RE) has the potential to drastically lower energy costs and global warming. Energy, which originates from a range of sources including nuclear and fossil fuels (coal, oil, and natural gas), is necessary for every facet of modern civilization. Strong greenhouse gases (GHGs) such carbon dioxide (CO2) [9-12], sulphur dioxide [13], and nitrogen dioxide are released during the burning of these energy sources and are detrimental to the environment and general public's health.

II. Methodology

Proposed system

The implementation of proposed system in MATLAB / Simulink. This system is designed with two area voltage sources of 735 KV each connected with transmission line. Load of 200 MW each is connected before fault, near to sending point after load. As represented for controlling reactive power STATCOM is used with its controlling system. Fig.1. shows the MATLAB Simulink model of proposed system, where to control the STATCOM, PI controller [14] and Fuzzy based controller [15] are used.

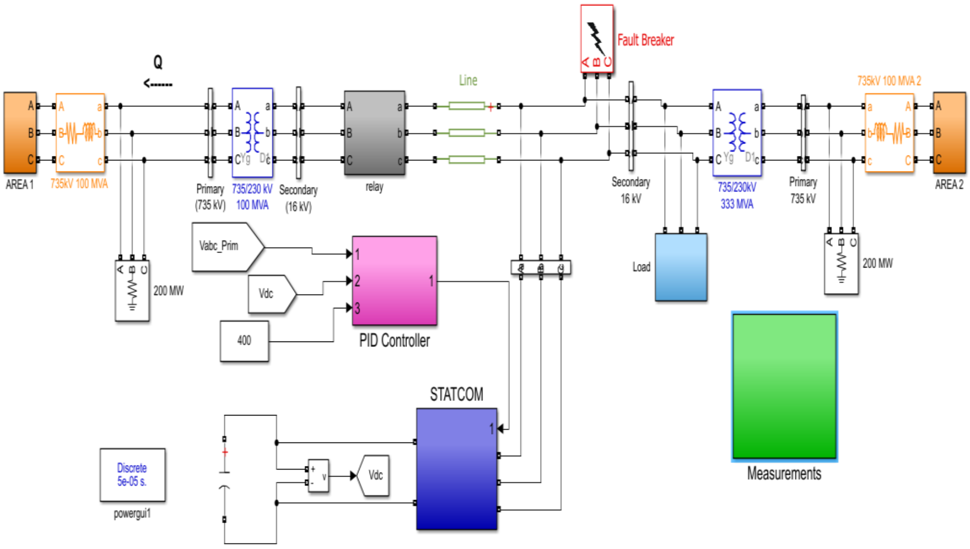

Fig.1. MATLAB Model for proposed system.

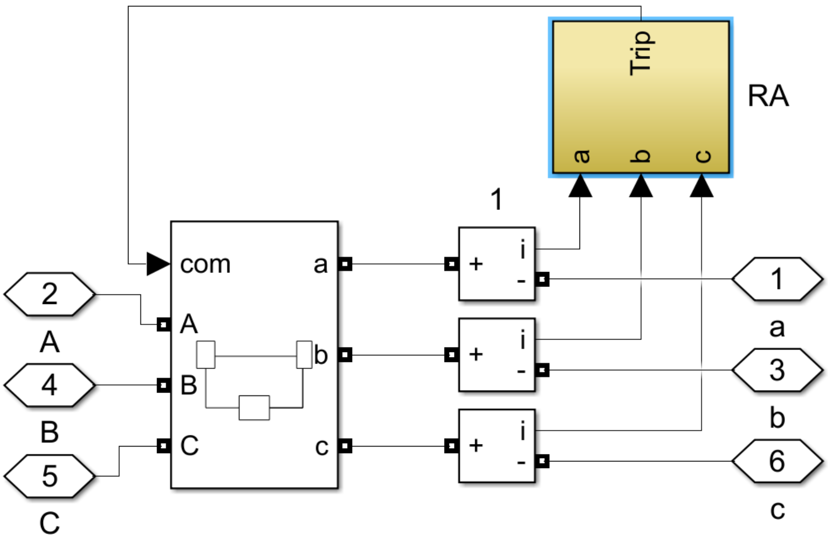

Fig. 2. Overcurrent relay in system.

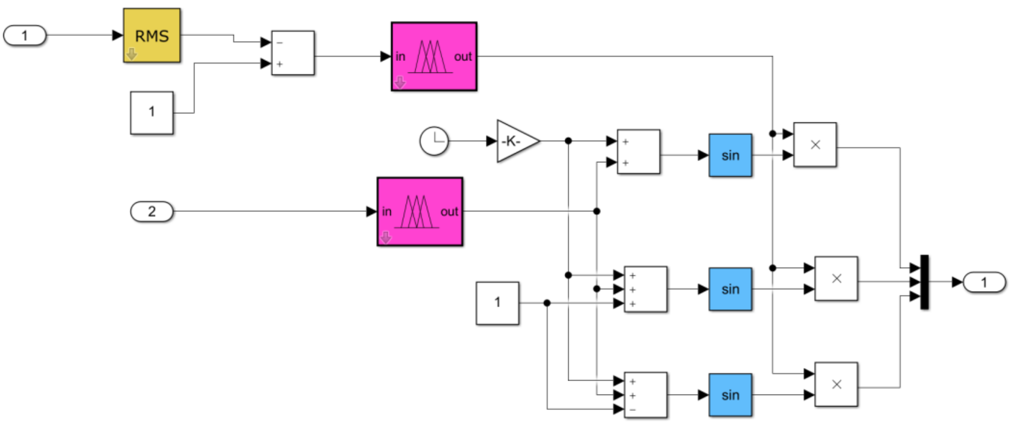

Fig.3. Structure of Fuzzy Logic Controller for STATCOM

Structures of PI Controller is shown in fig 3. This circuit is designed with voltage input from line as reference for controlling and PI controller [16] used to controller pulses for it.

Table 1: Parameter used in power system.

S.No	**Parameter**	**Values**
1	Voltage Source	735 KW
2	Load	200 MW
3	Line Load	300MW
4	Relay	Instantaneous Overcurrent relay
5	Fault time	0.1
6	System	2 Generator system

III. Results

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 PI and Fuzzy logic controllers (FLC) are compared and 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.

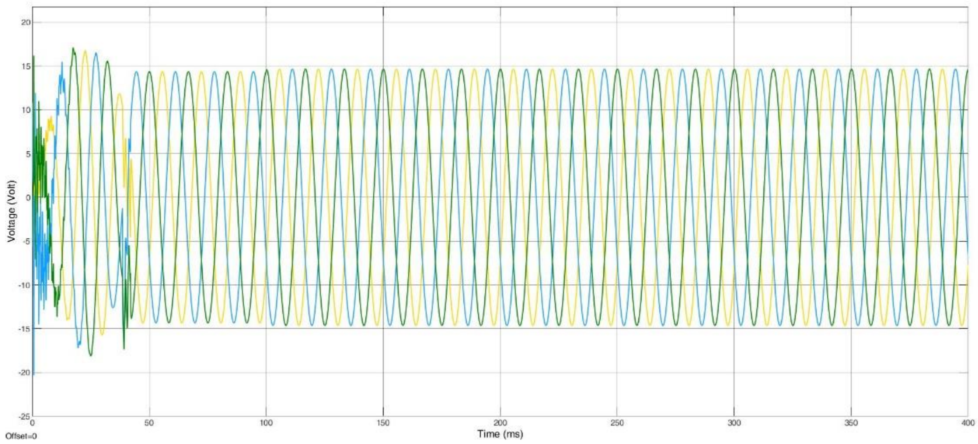

Fig.5. Bus Voltage before relay with PI

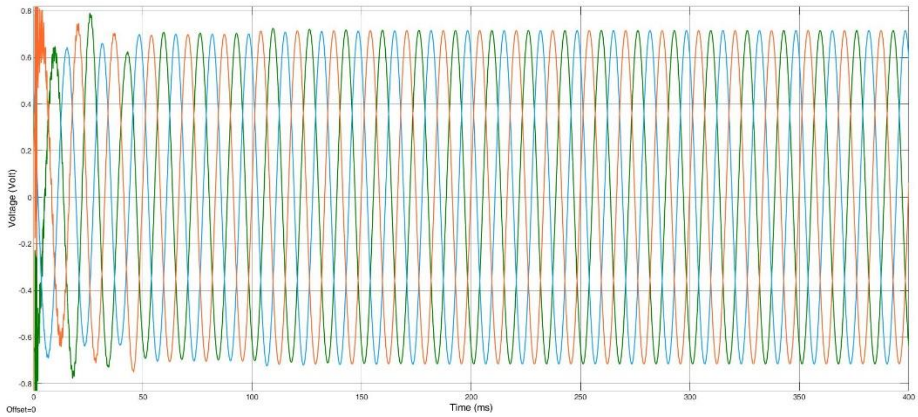

Fig.6. Bus voltage before relay with FLC

Figure 5 & figure 6 represented the bus voltage of bus before relay with PI and FLC respectively it shows that the voltage in PI circuit is not controlled by rating as compared with circuit connected with Fuzzy Logic Controller. FLC used with STATCOM also controls the voltage Parameter in power system.

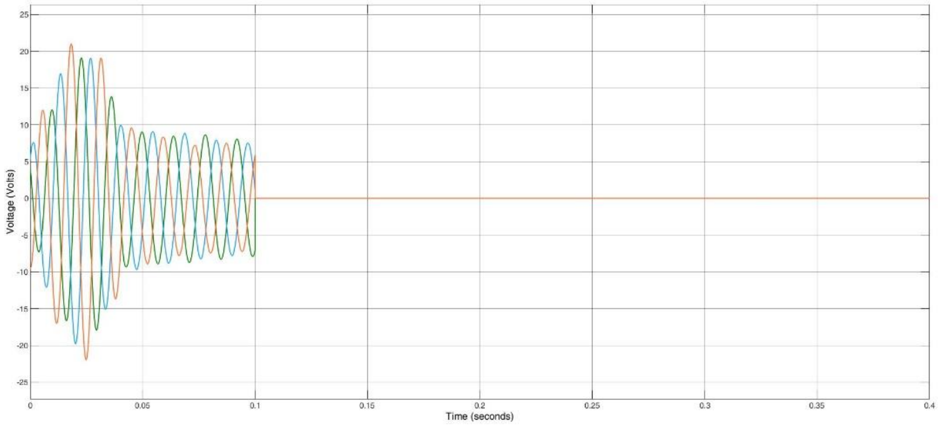

Fig.7. Bus voltage after relay with PI

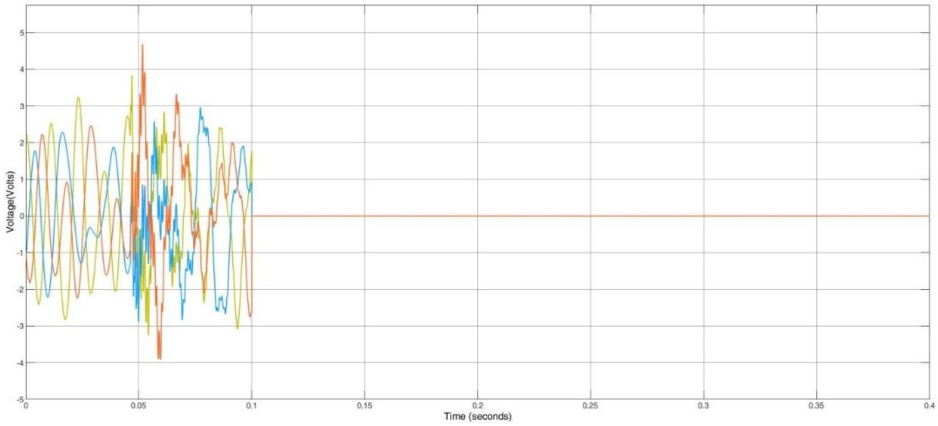

Fig.8. Bus voltage after relay with FLC

Figure 7 & Figure 8 represented bus voltage of bus connected after relay with PID and Fuzzy Logic Controller respectively. These waveform shows the control of voltage and relay operation after fault condition. As in PID there is leakage in voltage where as in FLC the voltage is completely cutoff as relay is operating condition. Overcurrent relay operates at 0.05 μs in FLC.

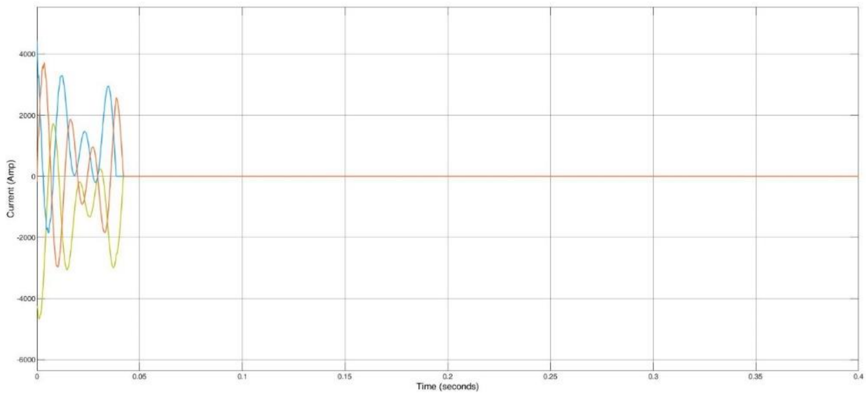

Fig.9. Current in bus before relay in PID

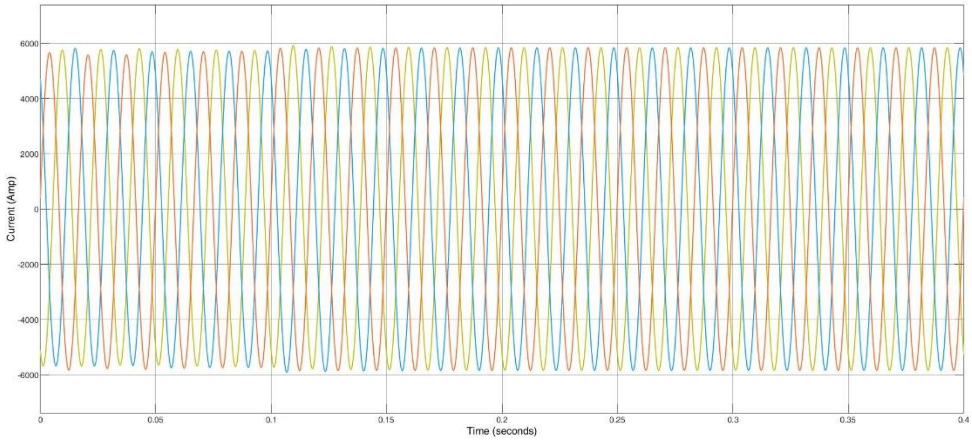

Fig.10. Current in bus before relay with FLC

Figure 9 & figure 10 shows current parameter of bus connected before over current relay and fault with PID and FLC respectively. This shows that with PID the current gets zero before relay conditions, due to fault but in condition of FLC it will remain in normal condition as the fault occur after this bus. So FLC is working more effectively in the System.

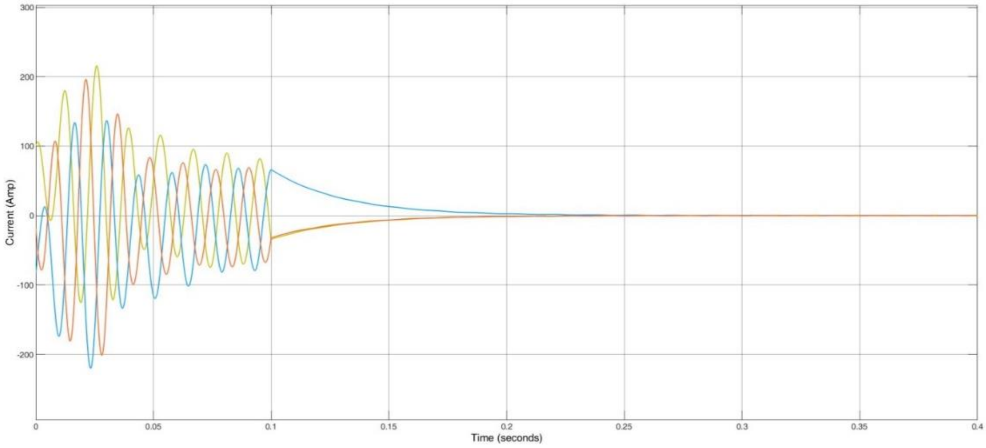

Fig.11. Bus current after relay in PID

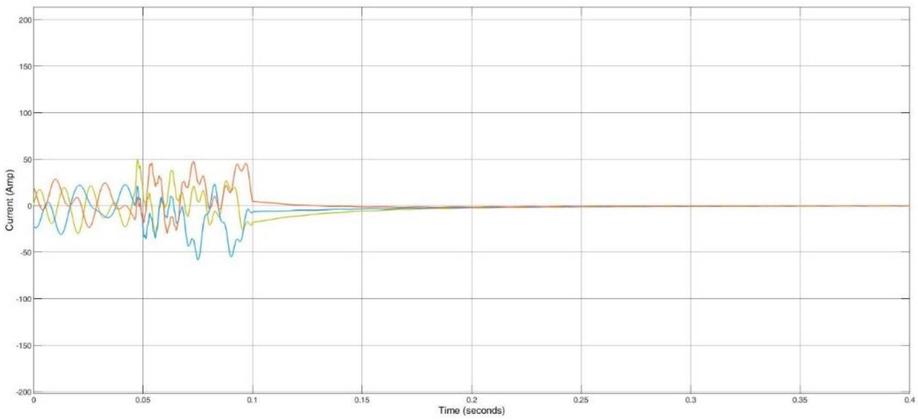

Fig.12. Bus current after relay in FLC

Working condition of bus current in case of PID & FLC is represented in fig. 11 & fig. 12 respectively. It shows that there is leakage current in case of PID where in FLC it is controlled.

IV. 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 PI and fuzzy logic controller for optimization of reactive power and working of overcurrent relay in case of fault. Overview of system is presented with mathematical modelling and its analysis using comparison of PI and FLC is in this paper. The overall analysis of proposed system shows that fuzzy logic controller is more optimized as compared to PI. While using PI controller relay works with either bus connected to and fro where it contains harmonics in its output. Similarly, on other hand fuzzy logic controller works for that bus where fault occurs and it controls active and reactive power also in optimized conditions.

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