

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. At the point when number of power unit expands, the interconnection of these units additionally get perplexing and element of overcurrent and reactive power likewise increments. For this situation when issue happens in the line these boundaries get outstanding increment and drop the less than receiving end power. To oversee overcurrent, transfer is utilized to be specific overcurrent relay and to streamline responsive power FACTS devices are in pattern. The STATCOM is most widely used FACTS device to enhance the power quality in the distribution system. To control the STATCOM, controller is used. Fuzzy logic controller is latest controller that can integrate with the STATCOM in the system and can improve the power quality of the system.

Keywords—*Power Quality disturbances, FACTS devices, STATCOM, Fuzzy Logic Controller.*

I. 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 are 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.

Relays play an important role in protection of any electrical system. Relay prevents the system by separation from faulty area / part so it can't damage health area. Proper use of relay and its tuning gives a strong system and prevent from break down. FACTS devices along with relay are best to increase the efficiency of power system.

This article focuses on the theoretical analysis of relay by implementing fuzzy logic controller for controlling voltage and current parameters. For the overall protection of power system, it is required to identify faults and resolve it within time frame. For this purpose, relays can be used at deferent point of system for different fault conditions. According to this article over current relay can be used for transmission line faults so that further damage can be controlled. FACTS device is also used as STATCOM for reactive power compensation.

II. LITERATURE REVIEW

B. Vandiver et al 2016 Paper transfer recognizes more issues identified with advancement in the relay test - which has just been surely known that the capacities utilized in structuring security components/feeder security systems are interconnected with present day complex programmable rationale. The principle issue is a similar present day calculation and consolidated security component arranging rationale that empowers current feeder wellbeing to work securely and dependably keeps us from utilizing the heritage testing strategies that are trusted for our "get" components. is. Paper analyzes the diverse customary single capacity protection to their advanced

substitutions and shows how heritage testing is deficient. [1]

M. Jaworski et al 2016 The paper centers around the fundamental standards of electrical system reclamation on the voltage increase approach, utilizes a recreation model which permits examination of the system in its ordinary activity state and rebuilding status. Examination of shortcoming situations is done to decide the degree to which as far as possible isolating the damaged from the broken system position shifts as indicated by the past system circumstance and how it is reflected in the transfer settings. Aside from this, a short assessment of topological improvements and separation security transfers their impact on the clearing time of the relay. [2]

H. Zhan et al 2016 The first relay presents an ideal DG position technique to expand the passageway level of DG in the circulation arrange, without changing security plans. Hereditary calculations are utilized to locate DG's ideal areas and sizes in the dissemination organize. Reproduction studies have been done on the three-feeder test conveyance arrange and the generally utilized 33-hub testing system to demonstrate the viability of the proposed technique [3].

Y. Yuanbo et al 2017 the paper investigates the basic innovation of condition based upkeep in relay protection, and particularly gives more consideration to the on-line state support of optional circuits, including AC simple circuit, switch info circuit and breaker working circuit. Right off the bat, the paper utilizes a relative strategy to successfully screen the AC simple circuit. Regardless of how relay security gadgets are designed, any AC simple circuit of the transfer protection gadgets can be matched by other

reasonable AC simple circuits. [4].

E. Patrashkin et al 2017 the creators have created structure standards for physical models of the savvy lattice system. This system incorporates physical models of estimation units, control and assurance gadgets, and furnishes information move in consistence with IEC 61850. The creators propose to utilize GOOSE-messages to transmit estimation results from the estimating current and voltage transformers situated at remote hubs of vitality organize. The outcomes can fundamentally diminish information move rate request of the focal relay security and mechanization arrange system [5].

H. M. Sharaf et al 2018 This paper is associated with the matrix and proposes a correspondence helped double setting transfer security conspire for the miniaturized scale network with the capacity of the island. The past work on the double setting relay has been executed on disseminated system associated with the network, yet the disappointment of the reinforcement plan is to work in a noteworthy low planned way. The proposed arrangement relies upon the utilization of double setting directional over crack hand-off, which are equipped for working with low data transmission correspondence both in front and back, with various settings, and keeping up legitimate security coordination. The issue is made as a non-straight urgent programming issue, where relay settings are set to diminish the general relay working time for essential and reinforcement tasks. [6].

III. PROTECTION SCHEMES

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. In many ways, there is better mobility in it, along with less cost of maintenance, along with investment costs and operating costs also decreases. The operating structure and basic structure of STATCOM is shown in Figure 1. Where V is the voltage and I have the source current.

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. The combination of energy storage on the DC-side of the converter is the next step of STATCOM development. [2-3]

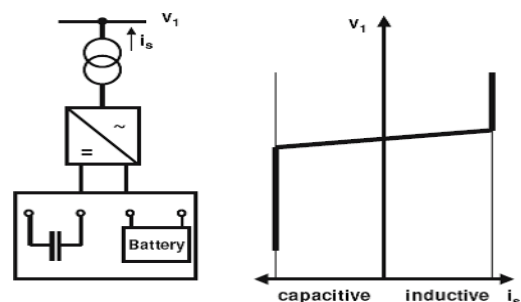


Figure: 1 STATCOM Structure and Voltage / Current Characteristic

Fuzzy Logic Controller

A general fuzzy controller consists of four modules:

1. a fuzzy rule base,
2. a fuzzy inference engine,
3. a fuzzification module, and

4. a defuzzification module.

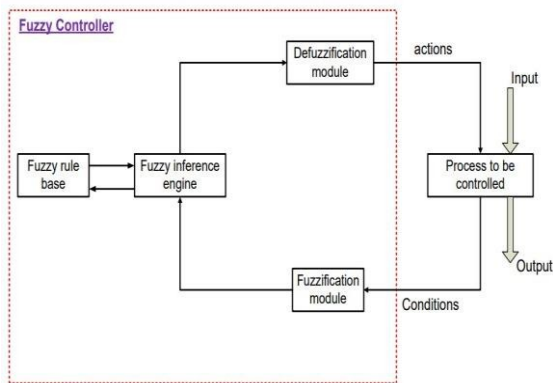


Figure: 2 General Block Diagram of FLC

Operation of FLC can be divided in following steps;

1. Measurements (inputs) are taken of all factors that address applicable state of regulator process.
2. These estimations are changed over into proper fluffy sets to communicate estimations vulnerabilities. This progression is called fuzzification.

IV. CONCLUSIONS

The proposed article is related to the analysis of overcurrent relay and STATCOM for micro grid system. It confirm that by using fuzzy logic controller for optimization of reactive power and working of overcurrent relay in case of fault. After a detailed discussion we have concluded that STATCOM can be used with Fuzzy Logic Controller to improve the quality of electricity in a microgrid. It also improves the value of total harmonic distortion (THD).

V. FUTURE WORK

The system that is proposed in this work, if someone extend it then more complex FACTS devices may be used and relay system can be controlled using

programmable resources and controllers for tripping and detection of fault conditions.

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