"STUDY OF UNIFIED POWER QUALITY CONDITIONER (UPQC) TO ENHANCE POWER QUALITY"

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ABSTRACT: *In this project the work is propose for power angle control (PAC) to improve power quality (PQ) in distribution system. This algorithm reduces mathematical complication and its response time. It has aimed to make the designs of controller. The new concept is incorporates on triangle rules of vector addition/subtraction. The mathematical approach makes the algorithm efficient and comprehensive. The shunt voltage source converter (VSC) of unified power quality conditioner (UPQC) is controlled using instantaneous symmetrical component theory (ISCT). The ISCT enables UPQC to handle unbalanced and non-linear loads. The complete phasor diagram has been shown for various voltage conditions. A vector addition and subtraction-based mathematical calculation has been derived for estimation of different parameters of the proposed system. Proposed PAC can improve PQ in four wire distribution system with maximum utilization of series VSC of UPQC. A simulation study for voltage sag/swell with the new algorithm for PAC verifies the improved performance of the system. Results have been discussed in detail.*

Keywords: PAC, voltage source converter, unified power quality conditioner), instantaneous symmetrical component theory

1. INTRODUCTION

With advancements in power electronics technology, power quality is becoming an important area in electrical engineering. With custom power reliability required power quality issues mitigation is necessarily required. Effects of poor power quality are discussed In general, poor power quality may result into increased power losses, abnormal and undesirable behavior of equipment, interference with nearby communication lines, and so forth.

The widespread use of power electronic based equipment has put further burden on the power system by generating harmonics in voltages and currents and increased reactive current. Active power filters (APF) have made it possible to mitigate some major power quality problems Extensive and well-documented surveys on the APF technologies covering several aspects are put forward. A number of devices have been developed to mitigate the power quality problems. These devices have been named as custom power devices. The Unified Power Quality Conditioner (UPQC) is a custom power device which is integration of series and shunt active power filters with common DC link .UPQC is one of the APF family members where shunt and series APF functionalities are integrated together to achieve superior control over several power quality problems simultaneously.

2. LITERATURE SURVEY

1. **V.Khadkikar in [5] presented a comprehensive review about unified power quality conditioner (UPQC)**.The paper proposes details of UPQC topologies. Different configurations of UPQC based on different applications are discussed. The paper also provides control strategiesused for UPQC. 1.

2. **Khadkikar and A.Chandra in [9] put forward a control philosophy to compensate load reactive power demand through UPQC**.The method proposes a new functionality of UPQC in which both series and shunt active power filters supply the load reactive power demand. This helps in sharing of load reactive power and reducing the rating of shunt APF and hence overall UPQC. The method proposed is termed as "Power Angle Control" (PAC). A power angle difference is introduced between source and load voltage keeping both magnitudes of voltages same.

3. V.Khadkikar and A.Chandra in [10] proposed a concept of voltage sag and swell compensation and load reactive power compensation by utilizing the series inverter of UPQC. The concept put forward is an extension of PAC. The active power control approach of UPQC is integrated with theory of PAC to co-ordinate load reactive power between 2 inverters. The series inverter delivers active and reactive powers simultaneously hence this concept is termed as UPQC-S.

M.Qasim and V.Khadkikar in [11] introduced estimation and regression technique in area of artificial intelligence called as Artificial Neural Network (ANN) and demonstrated its application in shunt active power filter control. ANN is important tool in control applications because of parallel computing nature and high learning capability. Different ANN structures have been used for extraction of fundamental and harmonic current components in shunt APF control.

G. Kinhal, P.Agarwal, and H.O.Gupta in [12] investigated the performance of UPQC based on neural network. The paper compares the performance of PI controller and ANN based controller on UPQC and concludes that ANN based control of UPQC provides fast dynamic response and stable operation over a wide range.

B.Singh, K.Haddad andA.Chandra in [13] reviewed active power filters for power quality improvement. Full

classification of APF is carried and control strategies are discussed. Selection consideration of APF for different applications is also discussed.

H.Fujita and H.Akagi in [14] described UPQC with focus on flow active and reactive powers within UPQC. Compensation strategy is discussed in detail.

M.Aredes, K.Heumannand E.Watanabe in [15] proposed a Universal Active Power Line Conditioner based on converter topology. It can also be called as UPQC. Control strategies for both series and shunt converters are depicted.

M.Kesler and E.Ozdemir in [16] explained synchronous reference frame (SRF) theory based control algorithm for control of UPQC. The mathematical analysis of SRF theory is carried out and reference signals generation algorithm is implemented

3. POWER ANGLE CONTROL (PAC) STRATEGY

Conventionally, the shunt APF in UPQC compensated for current related problems like current harmonics, reactive power compensation and load unbalance problem while series APF was utilized for the voltage related problems like voltage sag and swell compensation. Hence, utilization factor of shunt APF is more as compared to series APF. This is because current harmonics and load reactive power demand are load dependent and shunt APF is connected across the load. This increases the rating of shunt APF.

In PAC, with proper control of power angle between source and load, reactive power demand can be shared by both shunt and series inverters without affecting UPQC rating.

Thus, PAC control strategy is important in better utilization of series APF and co-ordination of load reactive demand between two filters. Through PAC shunt filter rating gets reduced and hence, overall cost of UPQC is lowered. PAC is integrated with active power control for voltage sag/swell compensation.

4. UNIFIED POWER QUALITY CONDITIONER (UPQC)

Of all devices UPQC has better compensation capability over D-STATCOM and DVR

The performance of UPQC depends on how quickly the reference signals are generated for the filters. There are a number of techniques through which reference signals are derived for filters.

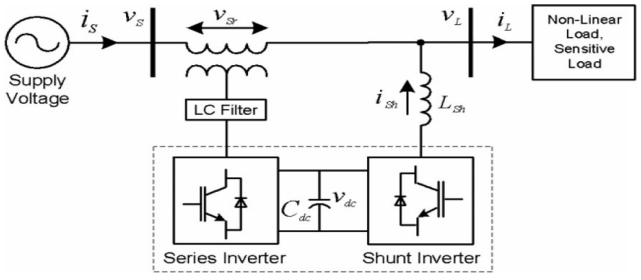
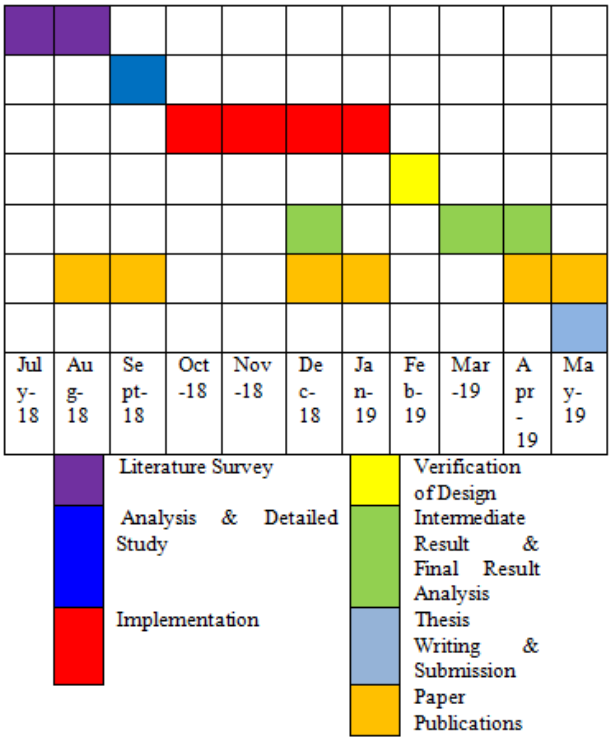


Figure 1: General Configuration of UPQC

5. PROPOSED WORK

1. Mathematical Formulation and Analysis of Power Angle Control (PAC) strategy.
2. Simulation of UPQC with PAC strategy for co-ordination of load reactive power demand between 2 filters using MATLAB/SIMULINK.
3. Simulation of UPQC with PAC strategy for voltage sag/swell compensation and load reactive power compensation using MATLAB/SIMULINK.
4. Study of ANN structures-ADALINE and Feed-forward MNN for extraction of components.
5. Simulation of shunt APF of UPQC using ADALINE and Feed-Forward MNN (ANN based control) using MATLAB/SIMULINK.

6. PLAN OF RESEARCH WORK



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