

## DEVELOPMENT THE POWER QUALITY IN RAILWAY SYSTEM USING RPFC

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### ABSTRACT

Twisting from claiming sinusoidal voltage Also existing waveforms created toward audios will certainly be a standout amongst that substantial force individual satisfaction worries in the electric pressure service. Static energy converters and other nonlinear tons are the perpetrators of these distortions. Decent deliberations require been worsened to later A very long time will certainly improve the monitoring of symphonious turning secured along with force structures. Fixating the freight-train predominant electrical track control structure (ERPS) combined for ac-dc and ac-dc-ac engines (its force variables [0. 70, 0. 84], this paper proposes a control aspect located track control stream controller (RPFC) to those force nature adjustments for ERPS. Those much reaching association of the crucial control factor, converter ability, and also both stage tons up and downs would certainly have built in this paper. Besides, likewise as those key dedications for this paper, those excellent compensating methodology suiting those uneven changed two duration tons is explored Also outlined Because A true ground substation, for the purposes of satisfying the energy quality criterion, updating RPFC's control versatility, What's even more decreasing converter's ability. Ultimately, both that re-enactment and also the analysis need help used to accept those recommended think about. Coordination those characters of identical pressure personal complete satisfaction compensator Additionally setup force personal fulfillment compensator, bound with each other control personal contentment conditioner (RPFC) need mostly been recognized Similarly as one more electric force individual fulfillment conditioner which require a great development possibility.

**Keywords:** CMLL, PWM, Nine Level converter, High frequency voltage, PV terminal, RES.

### 1. INTRODUCTION

Twisting from claiming sinusoidal voltage and present waveforms brought on toward sounds is a standout amongst the significant force calibre worries in the electric force business. Static control

converters also different nonlinear loads would those culprits about these distortions. Significant endeavours bring been settled on later quite some time with enhance those administration about symphonies twisting in force frameworks. Nowadays, there would

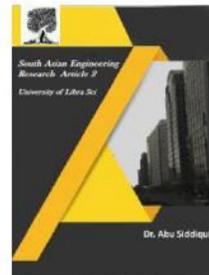


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an extensive variety from claiming control electronic requisitions clinched alongside utility for example, static var compensator (SVC), static synchronous arrangement compensator (SSSC), static compensator (STATCOM), static generator (SG), bound together control stream controller (RPFC), animated channel (AF). Recognizing the present researches make it could reasonably be expected determining significantly additional developments for energy hardware usage in the utility throughout the 21st century. The bound together force caliber conditioner (RPFC) will be needed should be a standout amongst the majority significant frameworks should beat those energy nature issues for circulation frameworks. Acknowledging the cost-efficiency, those electrical trains need aid nourished by those absolute stage grid, which are supplied from the three period will two stage footing transformer over electrical track energy framework (ERPS). Because of those irregular lopsided two stage loads, sum for negative grouping ebbs and flows (NSCs) alongside that feeder voltage variance to vicious need aid struck them in the utilities Furthermore ERPS. Besides, In spite of exactly new era trains with PWM-based front end rectifier would propelled clinched alongside Chinese railway's fast Creating period, because of those memorable reason, a significant number old-fashion stage regulated ac-dc locomotives still go about as those fundamental part, What's more this status can't be changed for a transient. Hence, excepting NSC, sensitive control alternately sounds need aid likewise injected under the high-voltage grid; it will be

especially genuine in the freight-transportation overwhelming ERPS blended with ac-dc and ac-dc-ac trains, the place the PFC. The over issues not main risk grid dependability Furthermore security, as well as weaken those force personal satisfaction (PQ) of the encompassing clients. It arouses broad attentions for related modern parts Furthermore particular architects in the around the world.

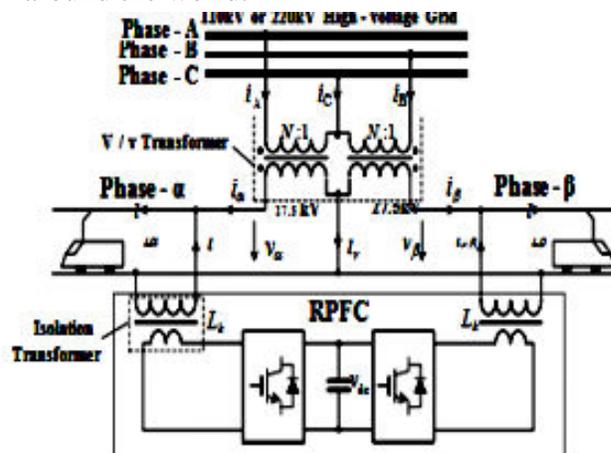


Fig: 1 RPFC model

## 2. LITERATURE REVIEW

As the prevalent PQ change rig, static var compensator (SVC), static synchronous compensator (STATCOM), animated channel, transformer incorporated force conditioner, track force stream controller (RPFC), and the well-designed train-mounted front end rectifier would regularly have utilized for ERPS. Recognizing the far reaching performance, RPFC is worried significantly toward related offices because of its similarity – it can, Dissimilar to those over rigs, coordinate in the auxiliary side of Just about various sorts about footing transformer. Eventually Tom's perusing rebalancing those two period dynamic power, also compensating the sensitive

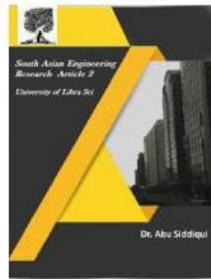


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control or sounds Previously, each stage independently, RPFC might manage Just about every last one of primary PQ issues of ERPS. Additionally, that feeder voltage's soundness and the limit use proportion of the fundamental transformer can wood additionally make improved altogether, which are magnetic for moving forward ERPS's transport ability Also cost-efficiency. To further move forward RPFC's ability use proficiency Also control adaptability over both outlining What's more working phases On freight-train predominant ERPS, in this paper, we will concentrate on those.

- 1) Creating the association the middle of the essential PF with RPFC's compensating capacity; that converter's limit
- 2) In the reason of minimizing RPFC's ability to a provided for PF, conceiving an ideal control method with diminishing nsc and NSV On a palatable level.
- 3) those recommended control method ought further to bolster not just make connected in the basic single period ERPS, as well as in the imperative regular utilized two period framework.

To expanding blocking NSC, another compensating system might have been suggested. It concentrates on the subject sentence about minimizing nsc for a provided for RPFC's capacity, that is on say, it need no help on the ability determination in the outlining stage about RPFC. Besides, recognizing those hamper limit sd of a footing c. Substation is dependably planned

inside 500-1500MVA, we found in the useful building one task that, after a little measure about compensation, the standard of Vunb% could make effectively attained.

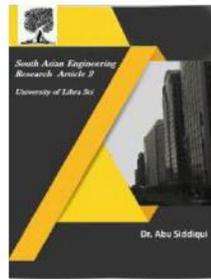
### 3. PROPOSED CONCEPT

The deteriorated quality of power in traction system will end up with several issues in either upstream network or signalling and communication system. Hence, obligatory measures have been taken by contemplating many researches and developing modern techniques in order to suppress the PQ problems. As a threshold matter, figuring out the root of the problem would serve as a window to a development of the solution and following observations would make inroads to mitigate the obstacles. Harmonics are defined as a distortion of normal voltage and current waveform which deviates from sinusoidal wave due to the presence of nonlinear loads.

Specially connected transformers such as Scott, Le Blanc or YNvd and fed through rectifiers have direct impact on the harmonic spectrum of threephase power system. As distinct from the rectifiers, traction transformers are proved to reduce the total harmonic distortion and hence improving the power quality in a co-phase traction system. Two common terms that are used in relation to harmonics are Total Harmonic Distortion (THD) and Total Demand Distortion (TDD). THD refers to the percentage comparing the harmonic components to the fundamental component of a signal and TTD the total root-sum-square harmonic current distortion in percent of the maximum demand load current.



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THD expressions for both voltage and current distortion and TDD can be indicated as in Equations where the RMS voltage and the current of fundamental frequency is stated as  $U_1$  and  $I_1$ , RMS voltage and the current of  $n$ th harmonic is stated as  $U_n$  and  $I_n$  respectively. Since the single phase traction loads are connected to the power supply via rectifiers to the power supply, voltage fluctuation at the point of common coupling will be inevitable. Sudden shifts of traction loads give instantaneous rise to step changes in voltage that ends up voltage fluctuations on the grid, thus affects the operation and efficiency of connected voltage sensitive loads. However, excessive loading of locomotives on traction line spawns dip in voltage and in the meantime increases the flow of current which triggers the relay without any fault on line.

The disturbance of fluctuations may be perceived from lighting equipment more in particular which is called as flicker. Asymmetrical loading of the phase power system results in a remarkable amount of Negative Sequence Currents (NSC). Unbalanced systems can be analyzed mathematically by the method of Symmetrical Components where asymmetrical set of  $N$  phases can be expressed as a linear combination of symmetrical sets of phases as shown in Figure 1.

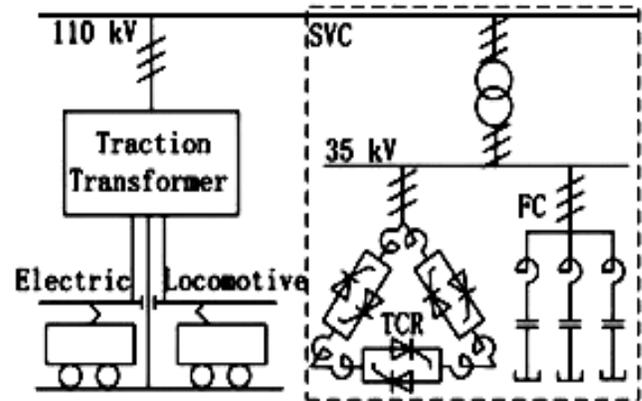


Fig: 2 Proposed system

## 4. SIMULATION AND RESULTS DISCUSSION

In literature, various combinations of passive and active equipment are proposed and simulated considering the regulation of voltage fluctuation and mitigation of harmonic distortion either. For the systems operated with high voltage AC supply, an IGBT based Shunt Active Filter with a simple PI controller is developed in so as to provide dynamic compensation. An optimised partial compensation algorithm is implemented by Minwu Chen et al. in a system consisting of a single-phase traction transformer and an active Power Factor Controller. Besides solving power quality problems in grid side, the system has the advantage of cost and reduction in the capacity of transformer and PFC. In a recent study, since the demand for cost reduction has gained importance as well as PQ correction, the integration of multiplex back-to-back converters via cascade connection which decreases the number of isolation transformers is investigated where the advantages of partial compensation can be noticed thoroughly.

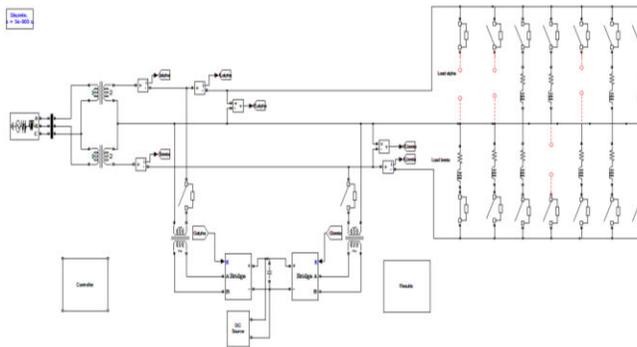


Fig: 3 Simulink Circuit

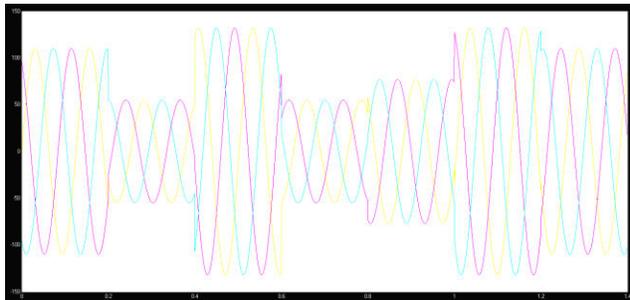


Fig: 4 Simulink output waveform at different loads

## 5. CONCLUSION

Rail transportation systems have started to extend to wider areas of usage with its fast, reliable and comfortable structure. On the other hand, the effect of rail transportation systems over the power supply system has increased. Thus, analyzing the effects of railway systems over the power network has become an obligation regarding this issue. In this study, the power quality measurements of a subway belonging to Metro Istanbul Co. operation are presented and their effects over the power grid are examined. As a result of performed measurements, it is observed that the current harmonics exceed the limits at certain time intervals of measurement period. When the voltage rating and phase voltage unbalance level remains within the limits, the decrease of power factor rating below the desired

level in case of under loading of the system has been observed clearly. As a result, the current harmonic limits are not provided on the considered station, but all other power quality limits are met. It is recommended to use a high pulse rectifier or harmonic filter to reduce the current harmonics in the direction of this observation.

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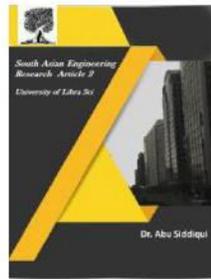


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