

**DEPARTMENT OF ELECTRICAL ENGINEERING  
DELHI TECHNOLOGICAL UNIVERSITY  
BAWANA ROAD, DELHI**



**CERTIFICATE**

This is to certify that the work entitled, “**Modelling of Unified Power Quality Conditioner (UPQC) for Power Quality Improvement**” has been submitted for the fulfillment of the requirements for the award of Degree of M.Tech in Electrical Engineering (Power System), carried out by Ravish Kumar under my supervision, at Delhi Technological University.

To the best of my knowledge, the matter embodied in the dissertation has not been submitted to any other University/Institute for the award of any Degree or Diploma.

J.N. RAI  
Department of Electrical Engineering  
Delhi Technological University

## **CANDIDATE’S DECLARATION**

I hereby certify that the work which is being presented in this dissertation entitled “**Modelling Of Unified Power Quality Conditioner (UPQC) For Power Quality Improvement**” by Ravish Kumar in the partial fulfillment of requirements for the award of Master of technology in Electrical Engineering (Power System), submitted to the Department of Electrical Engineering, Delhi Technological University, Delhi, is an authentic record of my own work carried out during a period of August 2012 to July 2013, under the supervision of J.N.RAI, Delhi Technological University. The matter presented in this dissertation has not been submitted to any other University/Institute for the award of M.Tech or any other Degree/Diploma.

Ravish Kumar

Roll No. 2K11/PSY/16

## **ACKNOWLEDGEMENT**

I wish to express my profound sense of deepest gratitude to my guide and motivator J.N. RAI, Electrical Engineering Department, Delhi Technological University, Delhi for his valuable guidance, sympathy and co-operation and finally help for providing necessary facilities and sources during the entire period of this dissertation.

I wish to convey my sincere gratitude to Prof. Madhusudan Singh, HOD, Department of Electrical Engineering and all the faculties of Electrical Engineering Department who have enlightened me during my studies.

The facilities and co-operation received from the technical staff of Electrical Engineering Department is thankfully acknowledged.

I would like to thank all my friends and especially my classmates, for all the thoughtful and mind stimulating discussions we had, which prompted me to think beyond the obvious. I've enjoyed their companionship so much during my stay at DTU, Delhi.

Last but not least I would like to thank my parents who provide me enormous support during my whole stay in DTU, Delhi.

Ravish Kumar  
M.Tech (Power System)  
Roll No. 2K11/PSY/16

## **ABSTRACT**

With the advent of power electronics and digital control technology, the renewable energy sources are increasingly being connected to the distribution systems in terms of wind, solar, hydro etc due to their free availability and low conversion cost. However, with the proliferation of the power electronics devices, unbalanced loads and nonlinear loads, the quality of the power evacuated from these renewable sources have degraded to large extent, which may often leads to distorted voltage and currents in the distribution network thereby affecting the reliability of the system.

Thus, stable operation of the distribution system amidst variety of unbalance at the connected load is a challenging task. Among various custom power devices, UPQC is considered to be the most promising solution for balanced operation of the system. It has the capability to offer control from both series as well as shunt end, thereby providing compensation to various power quality problems associated with the system.

The thesis proposes a control scheme for UPQC to enhance the quality and reliability of the electrical power generated in the distribution system particularly when connected to diode rectifier type non-linear load. Unified PQ conditioner (UPQC) is a versatile custom power device which consists of two VSCs connected back-to-back to compensate for both distorted PCC voltage and supply current imperfections. For a Non-Linear load, UPQC is designed to compensate the harmonic injected by the non-load from entering into the source terminal and regulation of voltage at the point of common is carried out by series connected converter. SRF based current control method is used for current compensation by the shunt device and Hysteresis voltage control technique is used for series device which simultaneously act as shunt and series active power filters. Also, maintaining a constant value for dc link voltage is necessary for UPQC to perform normally which is here carried out by shunt connected VSC. MATLAB based simulation is carried out to demonstrate the effectiveness of the proposed control scheme.