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ENHANCEMENT OF POWER QUALITY IN DISTRIBUTION SYSTEM USING D-STATCOM

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ABSTRACT

For some decades, power quality did not cause any problem, because it had no effect on most of the loads connected to the electric distribution system. When an induction motor is subjected to voltage sag, the motor still operates but with a lower output until the sag ends. With the increased use of sophisticated electronics, high efficiency variable speed drive, and power electronic controller, power quality has become an increasing concern to utilities and customers.

Voltage sags is the most common type of power quality disturbance in the distribution system. It can be caused by fault in the electrical network or by the starting of a large induction motor. Although the electric utilities have made a substantial amount of investment to improve the reliability of the network, they cannot control the external factor that causes the fault, such as lightning or accumulation of salt at a transmission tower located near to sea.

This paper presents the enhancement of voltage sags, harmonic distortion and low power factor using Distribution Static Compensator (D-STATCOM) with LCL Passive Filter in distribution system. The model is based on the Voltage Source Converter (VSC) principle. The D-STATCOM injects a current into the system to mitigate the voltage sags.LCL Passive Filter was then added to D-STATCOM to improve harmonic distortion and low power factor. The simulations were performed using MATLAB SIMULINK version R2007b.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Power Quality (PQ) has caused a great concern to electric utilities with the growing use of sensitive and susceptive electronic and computing equipment (e.g. personal computers, computer-aided design workstations, uninterruptible power supplies, fax machines, printers, etc) and other nonlinear loads (e.g. fluorescent lighting, adjustable speed drives, heating and lighting control, industrial rectifiers, arc welders, etc).

All nonlinear and time varying temporal type electric loads fall generally in two wide categories, namely the analog arc (inrush/saturation) type and digital converter (power electronic) switching type. The Electric Power Research Institute (EPRI) gives a rough estimation that in 1992, 15 to 20% of the total electric utility load was nonlinear and this trend in rising and is expected to reach 50 to 70% in the year 2000.

They are many reasons behind the growing concern about power quality such as the characteristics of the electric loads have changed dramatically with the proliferation of new microelectronics and sensitive computer type equipment, harmonics cause equipment to fail prematurely and also decrease the efficiency of the electric distribution/utilization network, increased load sensitivity and production automation.

The focus on power quality is therefore more of voltage quality as the momentary drop in voltage disrupts automated manufacturing processes, automation and efficiency relies on digital components which requires dc supply, as public utilities supply ac power, dc power supplies powered by ac are needed by the dc loads and lastly, as more dc power