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Abstract (251 Kb)

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# Simulation and Analysis of Various Configuration of MMC for New Generation STATCOM

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***Abstract*—A Modular multilevel converter (MMC) based new generation (NG) STATCOM for the improved power transfer capability and enhancement of power system stability have been presented. The MMC comes with a scalable technology which increases the voltage and power capacity. We calculate the mathematical equation for MMC, power flow result for an uncompensated system and NG-STATCOM based on MMC with a different configuration. The series-parallel configuration MMC based STATCOM gives better power profile over series and parallel configuration. All simulation has been done with help of MATLAB-SIMULINK.**

***Keywords—MMC; STATCOM; Power Transfer Capacity; Power System Stability***

## I. INTRODUCTION

The rapid growth in the development of power electronic in the power system gives opportunities to create new electronics equipment to improve transfer capacity and power system stability. With the increasing in complexity with an increase of new power station and transmission line resulted in a decrease in stability margin that may increase the chance of voltage collapse [1]. Voltage collapse in the power system is due to faults, heavily loaded and sudden increases in reactive power demand. The reactive power demand increases due to faults, heavily loaded and voltage fluctuation in the system. For optimal performance of the system, it's essential to control reactive power. Reactive power in the system can be balanced by connected electronics devices which inject or consume reactive power as per power system requirement [2].

Flexible alternative current transmission system (FACTS) devices such as STATCOM have been developed for the power system which injects or consume reactive power as per requirement [3]. FACTS devices are used for voltage regulation, power system stability, power flow control and power oscillation damping. There are many benefits of FACTS device like increase power flow capacity, improve system stability and power quality enhancement etc. [4].

This paper shows the performance of NG-STATCOM based on MMC are explained and we compare the performance of different configuration of MMC. The MMC gives more flexibility in converter, station design and made by identical sub-modules which can control individually. So the converter can behave as controlled voltage source.

## II. BASIC DESCRIPTION OF STATCOM AND MMC

IEEE definition: "A static synchronous generator operated as a shunt connected VAR compensator whose capacitive or inductive output current can be controlled independent of the ac system voltage."

STATCOM can be controlled capacitive or inductive output current independently of the AC system voltage and Static Var Compensator (SVC) can control line voltage by reactive shunt compensator [5]. STATCOM can be used as a voltage and current source converter based on as per requirement. Simple transmission line system is shown in fig.1

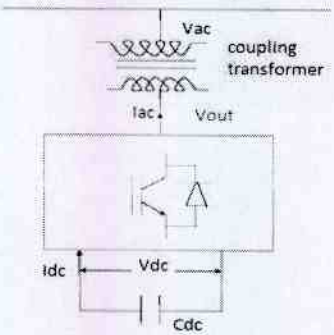


Fig.1. Single line diagram of STATCOM

The new generation STATCOM is act as voltage source converter (VSC) base on MMC technology. The MMC gives nearly ideal sinusoidal shape waveform on the output side. So that it is not necessary to use low order filter in the system and it is also provided low switching frequencies in each sub module with the low voltage across switch [6], which decrease the switching losses. Losses are lower by 1% for three level VSCs than two-level VSCs [7]. The harmonic distortion can be low by increasing effective switching frequency of converter by effective switching of sub-modules at different point of times [8].

Two-level half bridge MMC sub-module required two IGBTs shown in fig.3 whereas two level full bridges MMC sub-module required four IGBTs [9]. MMCs reduced on the