Mitigation of Voltage Sag

K. S. Kulkarni[1], Dr. D. P. Kadam[2], Nitesh Kumar[3], Yogesh Patni[4]
[1, 2, 3, 4] Department of Electrical Engineering
[1, 2, 3, 4] BKC-MET- Institute of Engineering, Nashik

Abstract- *Power quality is major concern in the Electrical field. It has become important with the introduction of sophisticated devices, whose performance is very sensitive to the quality of power supply. It is an occurrence manifested as a nonstandard voltage, current or frequency that results in a failure of equipment. Major problems deal is the voltage sag. Custom power devices are used for solving the problem. Dynamic Voltage Restorer (DVR) which is the most efficient and effective power device used in power system. Research paper presents modelling, analysis and simulation of a DVR using MATLAB software. In this model a PI controller and Discrete PWM pulse generator are used.*

Keywords- voltage sag, dynamic voltage restorer, PWM technique

I. INTRODUCTION

The electronic devices are very sensitive to disturbances and become less tolerant towards short duration variation and waveform distortion. Voltage sag is considered most severe disturbances to the equipment [1, 6].

Voltage support at a load can be achieved by reactive power injection at the load PCC [3]. Method for this is to install mechanically switched shunt capacitors in the primary terminal of the distribution transformer. To presents benefit of DVR, DVRs are power devices for providing reliable distribution power quality problem. They employ a series of voltage boost technology using solid state switches for compensating voltage sags. The DVR applications are mainly for sensitive loads that may be drastically affected by fluctuations in system voltage [8, 9].

II.VOLTAGE SOURCE CONVERTERS (VSC)

VSC is a powerful electronic device, which can generate a sinusoidal voltage with any required magnitude, frequency and phase angle. VSC are used in adjustable speed drives. Also it can be used to mitigate voltage dips. The VSC is used to either completely replace the voltage.

III. SERIES VOLTAGE CONTROLLER (SVC)

SVC is connected in series with the protected load. Usually the connection is made via a transformer, but configurations with direct connection via power electronics also exist. The resulting voltage at the load bus bar equals the sum of the grid voltage and the injected voltage. It generates the required reactive power & the active power is taken from the energy storage. DVR has limitations on the depth and duration of the voltage sag that it can compensate.

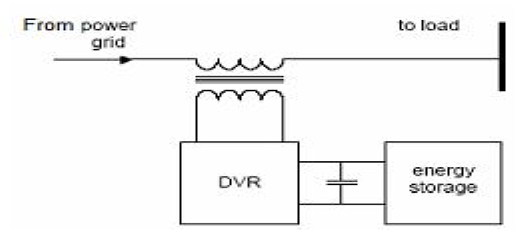

Fig.1. Dynamic Voltage Restorer

The system impedance depends on fault level of the load bus. When the system voltage drops, the DVR injects a series voltage V_{DVR} through the injection transformer so that the desired load voltage magnitude VL can be maintained. The series injected voltage of the DVR can be written as,

$$V_{DVR} = V_L + Z_{TH} . I_L - V_{TH}$$

Where

VL is the desired load voltage magnitude

Z_{Th} is the load impedance

IL is the load current

Vth is the system voltage during fault conditions

It may be mentioned here that when the injected voltage V_{DVR} is kept in quadrature with IL, no active power injection by the DVR is required to correct the voltage. It requires the injection of only reactive power and the DVR itself is capable of generating the reactive power. Note that DVR can be kept in quadrature with IL only up to a certain value of voltage sag and beyond which the quadrature relationship cannot be maintained to correct the voltage sag. For such a case, injection of active power into the system is essential. The injected active power must be provided by the energy storage system of the DVR.

A. Controller