CHAPTER 1

INTRODUCTION

1.1 Project Background

Electrical power is generated as an alternating current (AC). It is also transmitted and distributed as AC and, apart from certain and industrial drives and processes, it is consumed as AC. Nowadays, it is economically and technically advantageous to introduce direct current (DC) links into the electrical supply system. In such situation, it may be the only possible method for the power transmission. When two AC systems cannot be synchronized or when the distance by land or cable is too long for stable or economic AC transmission, DC transmission is used. At one converter station the AC is converted to DC, which is then transmitted to a second converter station, converted back to AC, and fed into another electrical network. In back-to-back HVDC schemes the two converter station are bought under the same roof, reducing the DC transmission length to zero.

HVDC transmission application fall into four broad categories and try scheme usually involved a combination of two or more of these. The categories are;
i) Transmission of bulk power where AC would be uneconomical, impracticable or subject to environment restrictions.

ii) Interconnection between systems which operate at different frequencies, or between non-synchronized or isolated systems which, although they have the same nominal frequency, cannot be operated reliably in synchronism.

iii) Addition of power in feed without significantly increasing the short circuit level of the receiving AC system.

iv) Improvement of AC system performance by the fast and accurate control of HVDC power.

The AC harmonic filter reduces the amplitude of one or more fixed frequency harmonic currents and voltages. Generally consists of one or more L-C tuned circuits. R-L-C circuits constitute a special type of damped harmonic filters. These filters, in additional to filtering the harmonic currents or voltages, can also reduce either overshoot or rate of rise of a transient current or voltage.

By definition, a filter F is a function of

\[ F = f [ Z_s, X_t, I_h, C_f, P, Q_t] \]  \[1\]

Where

\[ Z_s = \text{system impedance} \]
\[ X_t = \text{converter transformer reactance} \]
\[ I_h = \text{harmonic current at harmonic h} \]
\[ C_f = \text{filter capacitor} \]
\[ Q_t = \text{total reactive power demanded of converter} \]
\[ P = \text{active power transmitted by converter} \]
AC harmonic filter design is an integral and important part of HVDC converter station design. The AC filter constitutes about 15% [3] of the total cost of the converter station. The AC harmonic filter at an HVDC converter station Figure 1 shown as  the designed to control the converter generated level of AC harmonic which are injected into the AC system, in addition to providing reactive power for the converter.

![Diagram of HVDC converter station](image)

Figure 1: Layout of HVDC converter station

1.2 Problem Statements

The need to reduce the voltage and current waveform distortion to acceptable levels has been a problem in power system design from the early days of alternating current. In high voltage direct current, serious problem need to be undergo for avoiding hazardous to the electrical systems. The matters that need to be encounter are: