

A Seminar Report

On

FRACTIONAL FREQUENCY TRANSMISSION SYSTEM

Submitted in partial fulfilment for the award of the Degree of
Master of Technology in Electrical Engineering

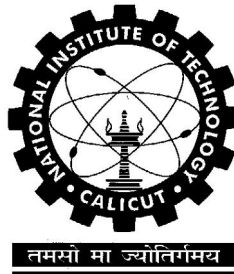
(Computer Controlled Industrial Power)

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ABSTRACT

Present day Power System uses the frequency of 50Hz and facing some Voltage and Power stability problems. In order to limit the problem a new method is proposed. The Fractional Frequency Transmission System (FFTS) is a very promising long-distance transmission approach, which uses lower frequency ($50/3$ Hz) to reduce the electrical length of the ac power line, and thus, its transmission capacity can be increased several fold. The proposed approach can multiply increase transmission capacity and remarkably improve operating performance. The structure and implementation scheme of the FFTS is discussed here along with the feasibility study and experiment conducted on FFTS. The performance of FFTS against conventional AC transmission system is compared here. The proposed method gives better result when compared to the conventional method.

CHAPTER 1

INTRODUCTION

Increasing transmission distance and capacity is always the motivation to advance power industry technologies. In the history of the ac transmission system, increasing distance and capacity mainly depends on raising voltage level of transmission lines. At present, the highest voltage level of the ac power transmission line in operation is 750 kV. To further upgrade, the voltage level encounters difficulties of material and environment issues. The high-voltage direct current (HVDC) transmission that has no stability limit problem once became another approach to increasing electricity transmission capacity. However, the current converters at two ends of HVDC are very expensive. In addition, up to now, the HVDC practices have been limited to the point-to-point transmission. It is still difficult to operate a multiterminal HVDC system. From 1982 to 2003, the total HVDC transmission capacity in the world was only 70 GW. The flexible ac transmission system (FACTS) has been used to improve power system performance and has become a very hot research field. The FACTS exploits power electronic techniques to regulate the parameters of the ac transmission, which can raise transmission capacity to some degree.

China is very rich in hydro-power resources. They are mostly concentrated in the West China. But the large loads are mainly located in the East and the South coast area where industry and agriculture are well developed. These conditions determine a basic structure of electric transmission from the West to East. The distance of transmission ranges from 1000 to 2500 km. The long distance transmission of electricity becomes an obstacle to hydro power development in China. At present, the DC transmission system is too expensive for China to widely use. The highest voltage level of AC transmission in China is 550 kV. This voltage level does not satisfy power transmission over 1000 km. It is said that at least 20 years are necessary to develop the transmission of higher voltage class and to manufacture the respective equipment.

In 1994, X. Wang proposed a novel electricity transmission approach, the fractional frequency transmission system (FFTS), which provides an efficient approach to solving the above problem. As it is well known, AC long distance transmission is mainly subject to problems with respect to steady and transient stability which are in turn restricted by its reactance's. The new transmission system uses fractional frequency (i.e. $50/3$ Hz in our study) to reduce the reactances of the AC transmission system, hence can multiply increase transmission capacity and remarkably improve its operating performances.

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