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High Power and Long Range AC Transmission Line Using HVDC Technology

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Abstract - Parallel ac-dc transmission improves transient and dynamic stability of the transmission and damps out the oscillations. This paper presents a simultaneous ac-dc power flow scheme through the same transmission line, giving the advantage of improved stability and damped oscillations and also controls the voltage profile by controlling the total reactive power flow. The paper outlays the advantages of high voltage dc transmission and the possibilities of simultaneous ac-dc power transmission. The project is stimulated and studied using the software Matlab.

Key Words: AC, DC, power, transmission, power grid, blackout, voltage profile, stability

INTRODUCTION

High Voltage DC transmission is a lucrative technology that incurs fewer losses for long distance transmission of electricity. HVDC also stabilizes the grid and can interconnect with AC networks. More electrical power can be transmitted over long distances through HVDC systems than AC transmission systems, thus money and land is saved by the requirement of fewer transmission lines. Along with this electrical losses over long distances are reduced. Also HVDC transmission is very stable and controllable , and can stabilize and interconnect AC power networks that are otherwise incompatible.

The rapid growing market of HVDC has become an important part of many transmission grids because of its ability to connect remote sources of electrical generation to load centre thousands of kilometres away. The HVDC transmission is an integral part of the electrical power systems improving their overall stability and reliability.

The core component of HVDC systems is the power converter, which serves as the interface with the AC transmission system. The conversion from AC to direct current (DC), and vice versa, is achieved by controllable electronic switches, called valves.

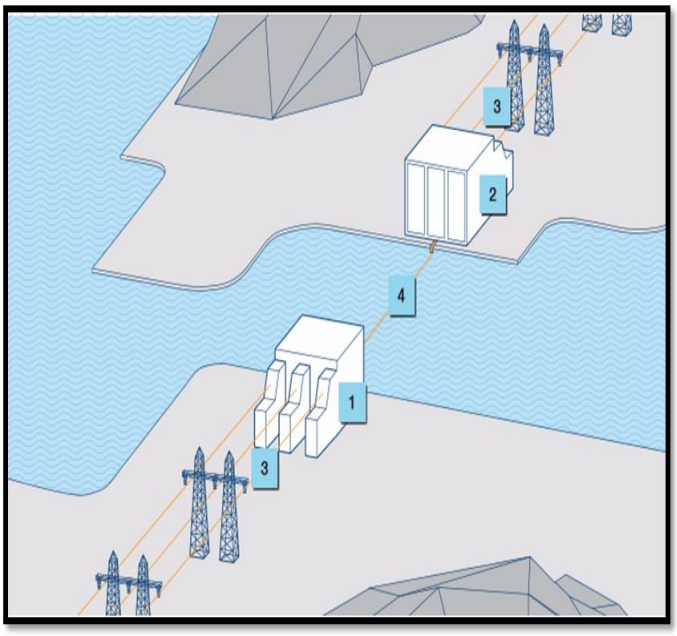


Fig 1- 1 HVDC converter station rectifier | 2 HVDC converter station inverter | 3 Alternating current (AC) | 4 Direct current (DC)

BASIC OF AC-DC POWER TRANSMISSION

Fig.2 depicts the basic scheme for simultaneous ac-dc power flow through a double circuit ac transmission line. Fig. 3 shows the following network that carries both ac-dc powers simultaneously.

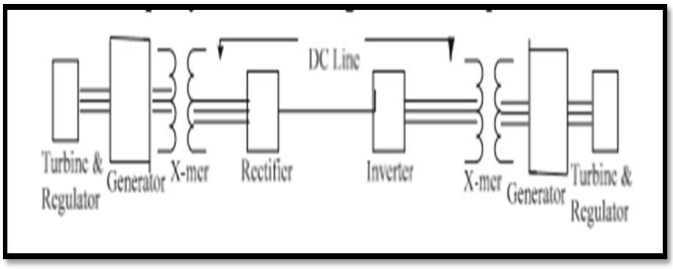


Fig. 2. Basic Scheme for composite AC-DC Transmission

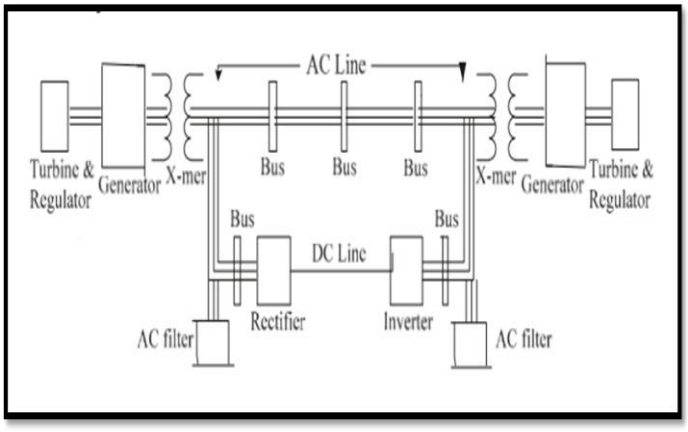


Fig. 3. Block diagram of proposed transmission network

HVDC ADVANTAGES

HVDC reduces electrical losses and costs, and also enables the use of renewable energy sources. Each transmission link has its own set of requirements justifying the choice of HVDC, but the most common points in favor include:

Asynchronous interconnections

Long distance water crossing

Lower losses

Controllability

Environmental concerns

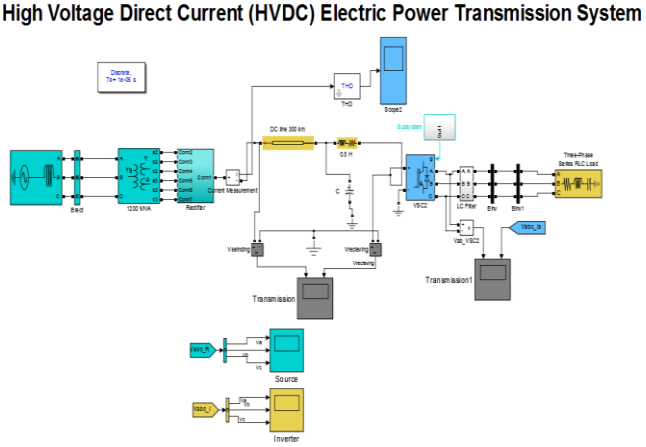
Limit short-circuit currents

Lower investment cost

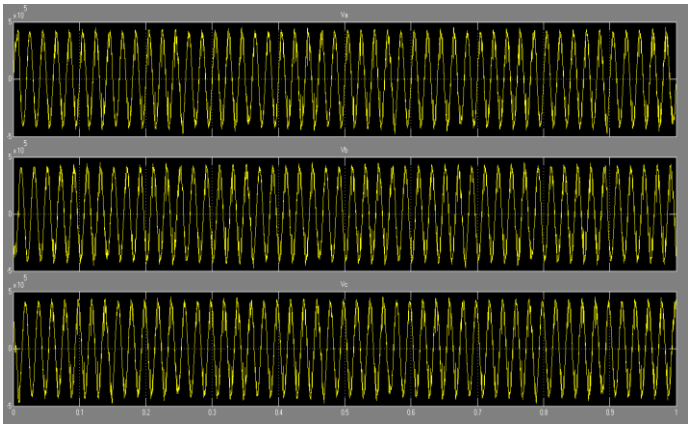
SIMULATION RESULTS

Using MATLAB Simulink, this circuit is simulated both at normal and faulty conditions. A simulation result has been taken separately by ac, dc and simultaneous ac-dc circuit.

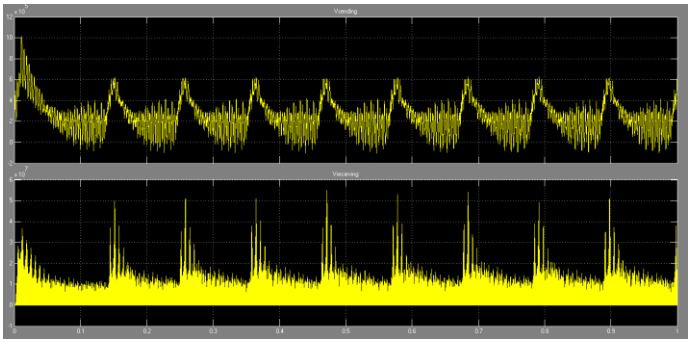
Stimulation model



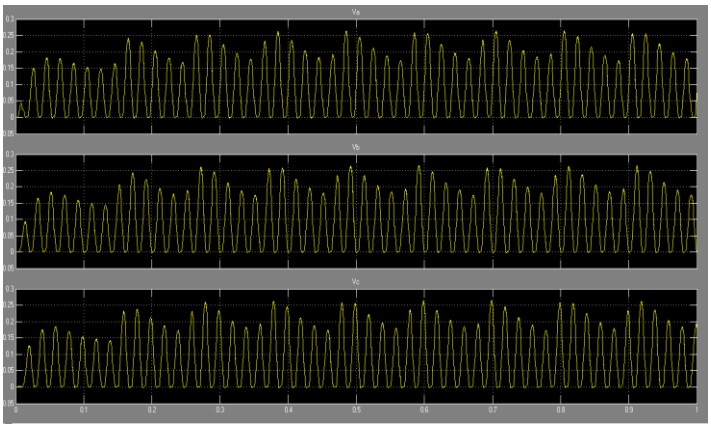
Source output



Transmission output



Inverter output



The proposed project has the following main governing points that are implemented during the development of the project.

1. We have implemented transmission line (more than 100km) between source and inverter.

2. We have implemented thyristor instead of diode rectifier (For high DC current transmission).

3. We have given supply source voltage upto 500 Kilovolt.

4. We have used method of thyristor switching for source and PWM-VSC for inverter.

5. We have analyzed AC to DC and again DC to AC Conversion waveform using separate scope.

CONCLUSION

This paper has presented the simultaneous ac-dc power transmission through the same transmission lines. The project is stimulated and studied through Matlab software. HVDC is the preferred system for use in a variety of transmission applications, using submarine cables, land cables and overhead lines due to its increased advantage of stability and fewer losses.

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