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MODELING OF POWER SYSTEM STABILITY ANALYSIS BY USING FEEDBACK CONTROL SYSTEM

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Abstract

In this project a new control strategy that can be used together with such a CCC is presented. In the new control system the inverter emulates the operation of a Voltage Source Converter, in the sense that, beside the control of the active power flow through the converter, the reactive power exchange with the AC network can also be managed in order to adjust the alternating voltage of the converter bus. Studies have shown that the interaction between the inverter and the connected AC system is significantly reduced, when the CCC is used together with this new control strategy. Keeping the alternating voltage constant makes it possible to control the DC-side voltage of the HVDC transmission system, allowing the rectifier converter to control the active power by means of controlling the direct current.This combination allows stable operation of the HVDC transmission system even under severe network conditions associated with low short-circuit power in the connected AC network at the inverter side.The obtained results show the effectiveness and robustness of these devices on power system stability.

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Reviewed by* **ICETSET'16 *organizing committee*

1. Introduction

The rapid development of power systems generated by increased demand for electric energy Multi terminal HVDC schemes are planned in the future. The main application area for HVDC is the interconnection between systems which cannot be interconnected by AC because of different operating frequencies or different frequency controls.

This type of interconnection is mainly represented by back-to-back stations or long-distance transmissions when a large amount of power, produced by a hydropower plant, for instance, has to be transmitted by overhead line or by submarine cable. HVDC schemes to increase power power transmission capability inside of a system have been used only in a few cases in the past.

However, more frequent use of such HVDC applications can be expected in the future to fulfil the requirements in deregulated interconnected ac power system, meeting the desired objectives for availability and operating flexibility, may also require the real time control of the line impedance and the phase angle.

The concept of flexible ac transmission systems or FACTS, which includes the use of high power electronics, advanced control centres, and communication links, to increase the usable power transmission capacity

to its thermal limit. When using carrier based Pulse Width Modulation, its switching frequency has to be increased (typically, 33 times fundamental frequency even higher), which cause considerable power losses.

The development of FACTS-devices has started with the growing capabilities of power electroniccomponents. Devices for high power levels have been made available in converters for high and evenhighest voltage levels. The overall starting points are network elements influencing the reactive poweror the impedance of a part of the power system.

The series devices are compensating reactive power.With their influence on the effective impedance on the line they have an influence on stability andpower flow.Therelevance of this device is given especially for studies and research to figure out the requirements andbenefits for a new FACTS-installation.

During the state of power exchange in interconnected lines to a substation under variable or constant power, the HVDC converters comprehends the power conversion andlater stabilizes the voltage through the lines giving a break even margin in the power transmission .

The operation of HVDC filters any system harmonics developed in the network and improves the power transmission to the receiving end by independently adjusting the real and reactive power control.

The significance of HVDC controller considered as part of FACTS family device is a structure of the back-to-back converter that governs the conversion of ac-dc-ac; like FACTS. HVDC is assigned for frequency and phase independent short or long distance overhead or underground bulk power transmission with high speed controllability.

This provides greater real power transmission and less maintenance. It reduces the chances of installing power cables especially in difficult transmission that travels under water. By making use of the back-to-back converters, power transmission under non-synchronous ac systems is easily adaptable. The installation of smoothing reactor the DC Current and reactive power compensation at the sending and Receiving-ends smoothing reactor andAC harmonics filter.

The installation of HVDC also depends on the dc voltage and current ratings desired in the network that Yields for optimum converter cost. The converters terminate. The DC overhead lines or cables that are linked to AC buses and network Rectification of voltage-current using the sending-end converter, pole 1 filters the system harmonics and ‘noises’ Occurring in the transmission. When power is filtered, the Conversion from DC is direct back into the AC line at the Receiving-end of the HVDC pole.

This sequence Operated instantaneously when matching the AC and DC Voltages during the conversion process. Requirements for this Conversion must have adequate impedance either on the AC or DC side of the HVDC.

The availability of the Smoothing inductors is to control the pulses of constant current flows into the transformer's secondary windings. This is because the transmission current has pulses travels from the Primary side of the transformer, which have specific types of Connection and ratio.

Thyristor schemes are more feasible in the converters. HVDC and FACTS used this scheme to generate automated switching for close accuracy in their voltage conversion. The HVDC rectifier produces commutation effects when power is fired into the pulses from the thyristor. The rectified power is only then sent to the inverter for power inversion back to the AC line with the required frequency at the receiving-end.

For an optimal converter utilization and low peak inverse Voltage across the converter valves, typical 3-phase bridge Converter is normally used. Simple transformers that installed in the lines resist voltage variation and high direct voltages when insulated.

stability are applicable, both in the time and frequency domains. In the FCS model, the relationships between different instabilities are clear, and participant agents of each instability can be determined. The model is developed in a modular and hybrid style, to make it feasible for a large power system. The proposed model is validated against an electromagnetic transient simulation program (PSCAD) using time responses.(Karawita, Osauskas).

BLOCK DIAGRAM FOR PROPOSED SYSTEM

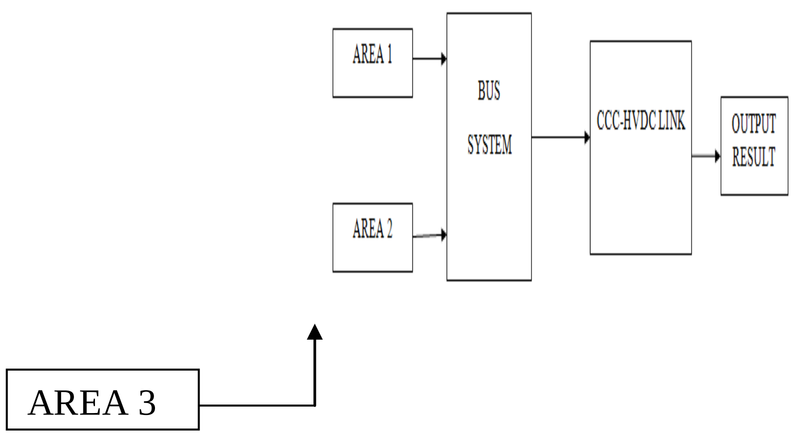


Fig 2.5. Block Diagram for Proposed System

In this Fig 2.5 block diagram having the description for CCC which having two area power system. Here these two areas are considered as thermal unit. The inputs are frequency deviation and tie line error for two area power system. The output will be showed individually in the simulation result. And these outputs are given to the controller. We need to train the controller then only we are get the better output. The output is in terms of dynamic response are considering as peak time, settling time and over shoot time. Here the controller is used to produce the optimum solution. The steady state power flow analysis is performed using decoupled jacobian method for the calculation of frequency deviation (ΔF) and tie line error (ΔP_{tie}). These are given as an input to the controller. Here train parameter used to train the neural controller. The dynamic response improved is shown in the output simulation.

2.5.1 ADVANTAGES

- High stability
- Reduced maintenance
- Better availability
- Greater reliability
- Increased power
- Reduced losses
- Cost-effectiveness

PROJECT DESCRIPTION

5.1 MODULES DESCRIPTION

5.1.1 AREA 1

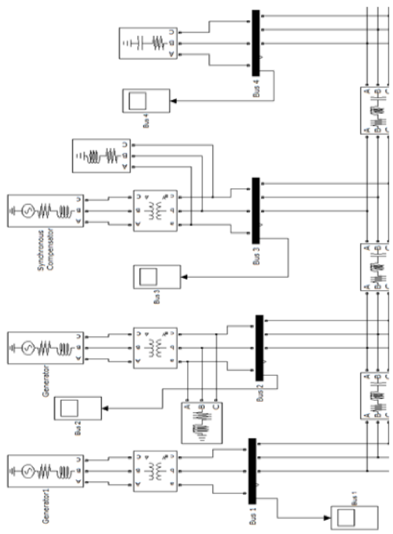
In this module we are going to developed area one with help of requirement specification in terms of frequency and tie line error. Here we are considering area one as thermal unit

5.1.2 AREA 2

In this module we are going to developed area two with help of requirement specification in terms of frequency and tie line error. Here we are considering area two as thermal unit.

SIMULATION MATLAB

6.1 CIRCUIT DIAGRAM



6.2 RESULT OF THE SIMULATION

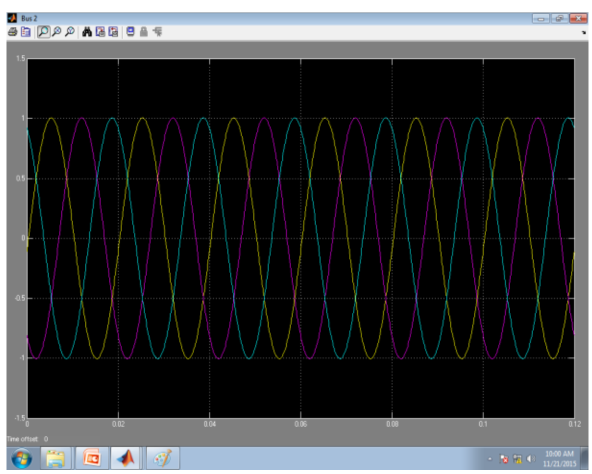


Fig 6.2 Output of Simulation Result

6.3 Stability of Transient Analysis

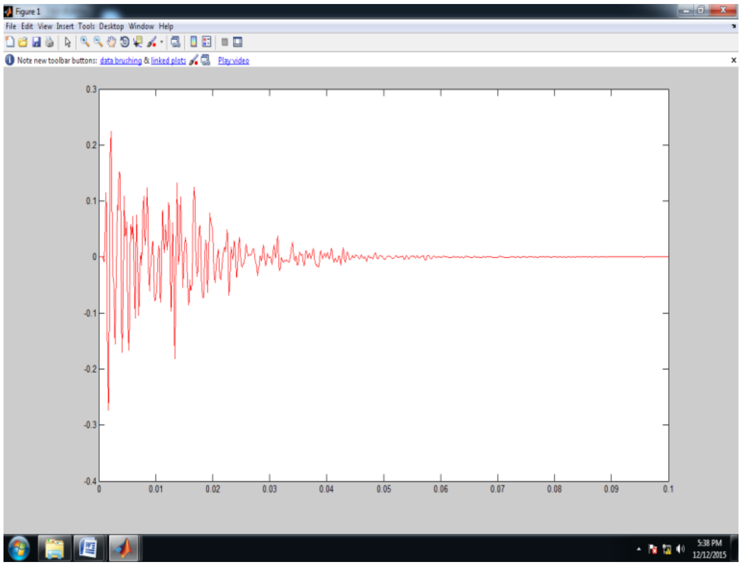


Fig 6.3.1 Output for Stability of Transient Analysis Generator 1

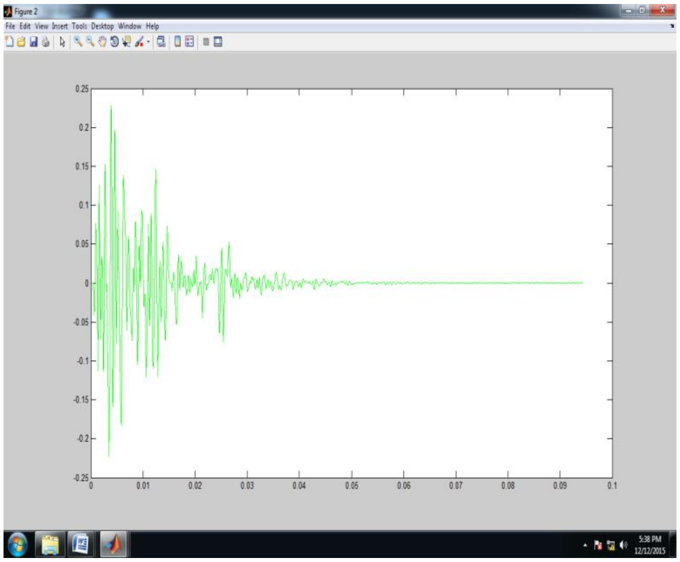


Fig 6.3.2 Output for Stability of Transient AnalysisGenerator 2

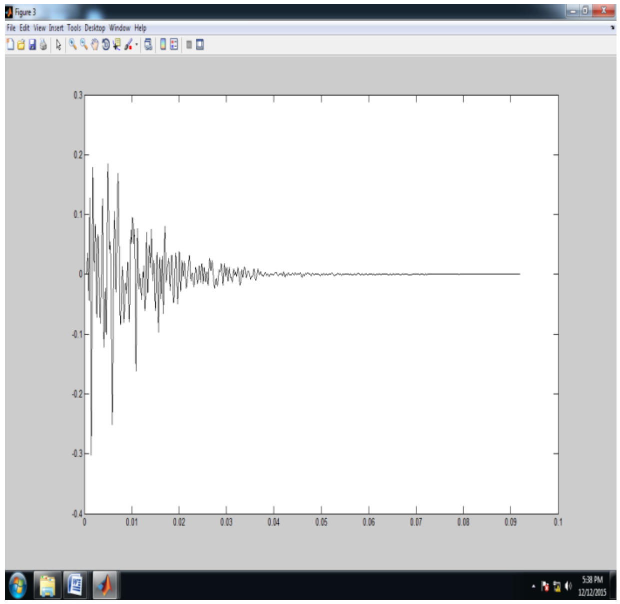


Fig 6.3.3 Output for Stability of Transient Analysis Generator 3

6.4 APPLICATION

THE RIO MADEIRA HVDC TRANSMISSION, FOCUSING ON THE CCC BACK-TO-BACK

The Rio Madeira HVDC transmission system consists of two bipolar transmissions rated 3150 MW each used to supply electrical power generated from the hydroelectric plants of Santo Antonio and Jirau on the Rio Madeira River close to Porto Velho to the main consuming areas in South-Eastern of Brazil (Araraquara region).

To supply power to the local load centre areas in the Acre-Rondônia region two HVDC Back-to-Back blocks of 400 MW each will feed power into long 230 kV AC lines .For the HVDC Back-to-Back converters, there are good reasons to investigate the performance of these converters in terms of the Voltage and Power stability conditions.

The reasons are that the connected 230 kV system includes very long AC lines, and that the system has almost no generation. The stability conditions of the 230 kV system are then strongly dependent on proper operation of the Back-to-Back converters. ABB has considered Back-to-Back converters using CCC to be a means to mitigate the interaction between converter and AC system. The use of CCC eliminates the need for the synchronous condensers, improves the Voltage/Power stability, reduces the temporary overvoltage as well as the risk for resonance at low frequencies.

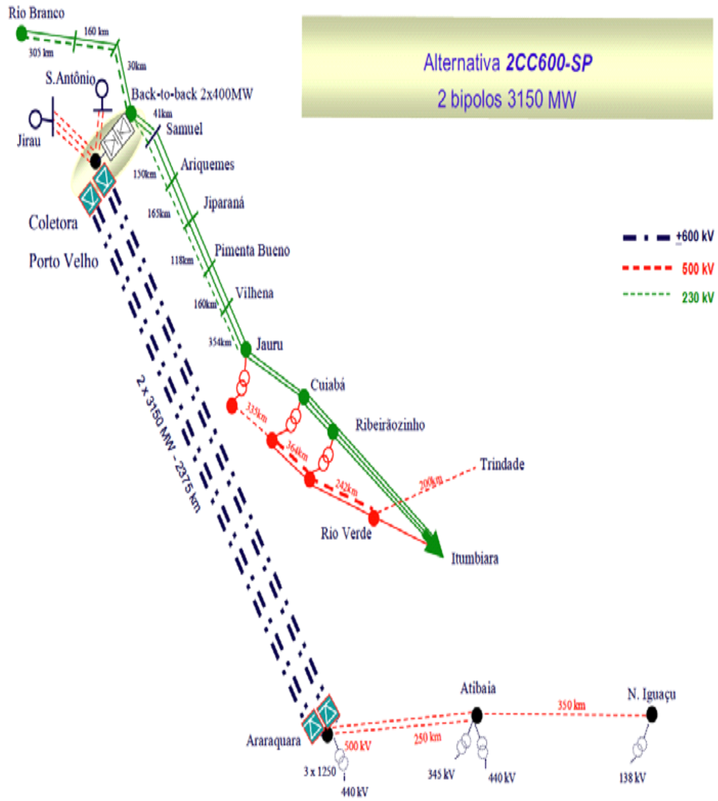


FIGURE 7: THE RIO MADEIRA HVDC TRANSMISSION SYSTEM AND THE AREA IN THE ACRE-RONDÔNIA NETWORK SUPPLIED BY THE CCC BACK-TO-BACK

The AC transmission lines in the Acre-Rondônia network are very long, resulting in that the impedance of the network seen by the converter is significantly influenced by the shunt compensation included in the network. It is also influenced by the generators connected in the Samuel power plant which is not far from the converter station.

CONCLUSION & FEATURE PLAN

An attempt is made in this paper to improve the dynamic performance of CCC of the interconnected power system by considering DC tie line. A simple but practical controller is presented to improve the dynamic response of CCC system in a realistic power system environment considering DC tie lines in parallel with AC tie lines. The output feedback controller for the power system with DC link gives better dynamic response having relatively smaller peak overshoot and lesser settling time with zero steady state error as compared to the power system considering AC tie lines. Dynamic responses are obtained for wide range of variation in load disturbance from 1% to 4% which satisfy the LFC requirements. Hence for all practical purposes, the controller is quite robust. The simulation results show that proposed control strategy considering parallel AC-DC tie line is very effective and guarantees good performance.

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