Performance Comparison of SVC with POD and Synchronous Generator Excitation System to Investigate Oscillation Damping Control on the GB Transmission System

Ronak Rabbani (Ronak.Rabbani@brunel.ac.uk), Ahmed Zobaa (Ahmed.Zobaa@brunel.ac.uk)
Gareth A. Taylor (Gareth.Taylor@brunel.ac.uk)
Brunel Institute of Power Systems (BIPS), Brunel University, Uxbridge, Middlesex, UB8 3PH, UK

Introduction

There is much interest in Great Britain (GB) among generation developers in the construction of new large-scale onshore and offshore wind farms, especially in Scotland. Therefore it is planned to reinforce the GB electrical power transmission system between 2013 and 2021 through the use of many more HVDC links operating in parallel with existing AC transmission routs, and also controllable reactive power sources such as SVC and TCSCs.

Methodology

This study investigates both SVC and HVDC link oscillation damping control schemes. The simple models represents both the HVDC link and SVC as elements in the power system that exhibit acceptable interaction with other systems elements. This overall system approach is considered in order to test and demonstrate such coordinated control. The simple models, which incorporate a control system, will be useful for implementation in a reduced model of the GB transmission system.

System Configuration and Modeling Approach

SVC Model
- Based on a 12-pulse TSC and a TCR
- Transformer consists of a star connected primary winding and dual secondary windings, one star and one delta connected

HVDC Control System
- Two 6-pulse converters
- AC filters and DC filters
- Transformers to connect the converter to AC line
- Two inductors on two side of DC link.
- The capacitor bank

SVC POD Control System
- To derive the speed deviation signal from the electric power
- Comparison a lead-lag compensator
- Creating an electric torque in phase with speed deviation

Generator
- Exciter Model
- Type ST1A
- Type ST2A
- Type ST3A
- Type ST5B
- Type ST6B
- Power System Stabilizer ModelType: PSS1A Power System Stabilizer
- Type DEC1A Discontinuous Excitation Control

Simulation Results

Conclusions

- Combination of PSS and SVC POD control system has a significant effect on the Ts and over shoot.
- Improving the power oscillation using PSS
- The Types ST1A and ST5B excitation systems have the best effect on power oscillation damping. The overshoot is almost zero for these types and both of them are settled less than 1 second after the occurrence of a fault.

Future Work

- Focusing on linking the PSCAD and Matlab programs for the design of advanced power oscillation damping control systems is planned.
- Reduced model of the GB transmission system includes 29 node, 98 transmission lines in double circuit configuration and one single circuit transmission line[2].
- Two HVDC links will be added (between busbars 2 and 10, 5 and 29)

References


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