

Figure 5: Simulink modelling TCSC

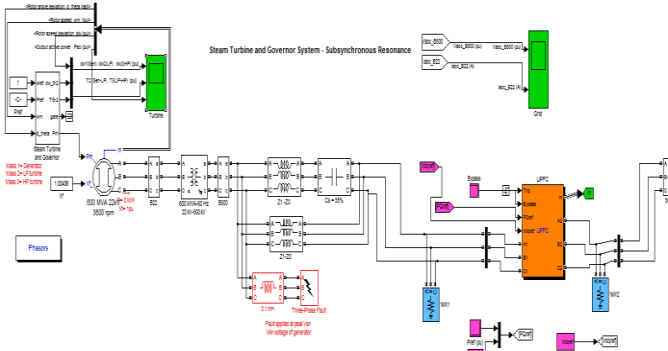


Figure 6: Simulink modelling UPFC

6. Simulation Results

The MATLAB simulation is carried using three specifications (1) System without FACTS device (2) System with TCSC (3) System with UPFC. Without FACTS device the system become more unstable for three phase fault at infinite bus. When FACTS device is connected to the series compensated line, it stabilizes the common mode oscillations.

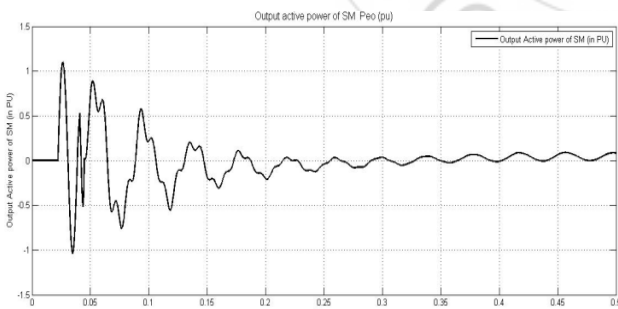


Figure 7: Variation of power without TCSC & UPFC

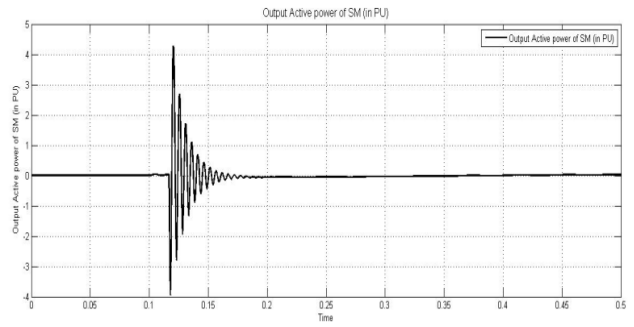


Figure 8: Variation of power with TCSC

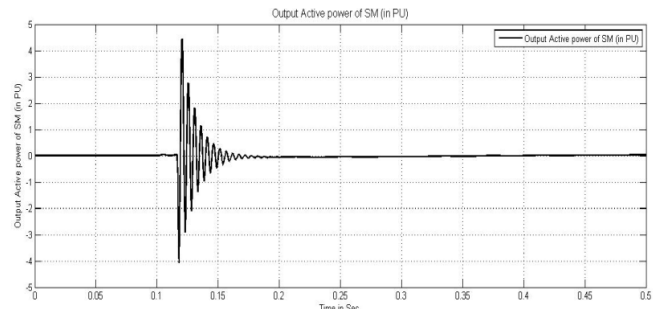


Figure 9: Variation of power with UPFC

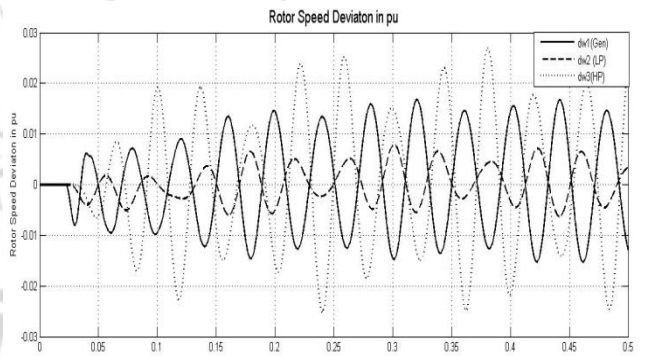


Figure 10: Variation of rotor speed without TCSC & UPFC

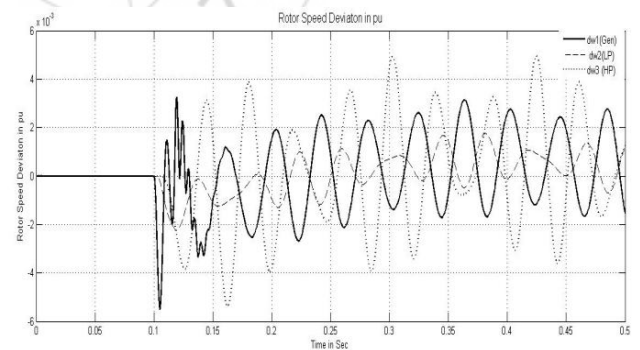


Figure 11: Variation of rotor speed with TCSC

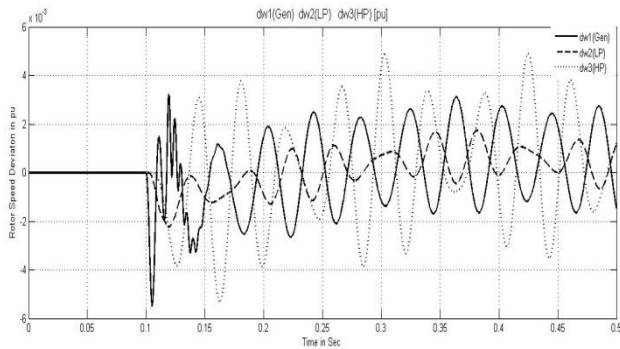


Figure 12: Variation of rotor speed with UPFC

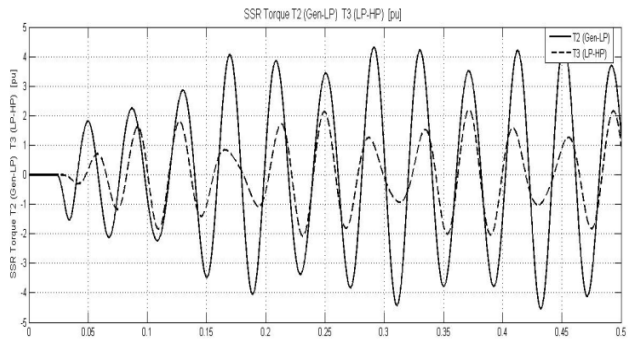


Figure 13: Variation of SSR torques without TCSC & UPFC

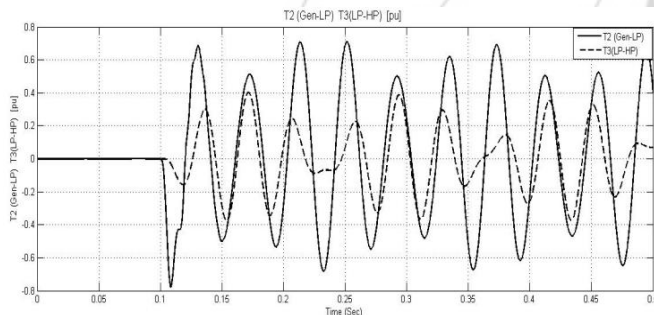


Figure 14: Variation of SSR torques with TCSC

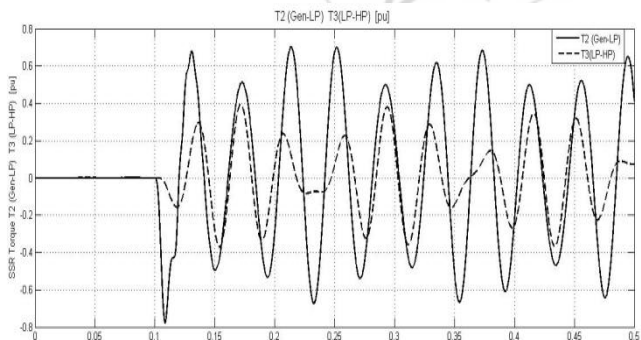


Figure 15: Variation of SSR torques with UPFC

7. Conclusion

In this paper IEEE Second Benchmark Model is used to study the subsynchronous resonance effect. The simulation results of two systems without FACTS device and with FACTS device like TCSC and UPFC are compared. From simulation results we can conclude that by placing TCSC & UPFC on a series compensated transmission line, there is a considerable variation in power flow, rotor speed and SSR torques. Hence the proposed FACTS controllers can

effectively damp the subsynchronous oscillations present in the power system. So these devices can be employed successfully to mitigate the SSR.

References

- [1] IEEE SSR Working Group, "Second Benchmark Model for Computer Simulation of Subsynchronous Resonance", IEEE Transactions on Power Apparatus and Systems, Vol.104, No. 5, pp. 1057-1064, 1985.
- [2] R. J. Piwko, C. A. Wegner, S. J. Kinney, and J. D. Eden, "Subsynchronous resonance performance tests of the Slatt thyristor-controlled series capacitor," IEEE Trans. Power Delivery, vol. 11, pp. 1112–1119, Apr. 1996.
- [3] Luiz.A.S.Pilotto., Andre Bianco, Willis.F.Long and Abdel-Aty Edris, "Impact of TCSC Control Methodologies on Subsynchronous Oscillations," IEEE Trans. Power Delivery, Vol.18., pp 243-252, Jan. 2003.
- [4] H.Hosseini, A.Boudaghi, A.Mehri, H.Farshbar and S.F.Torabi, "Mitigating Subsynchronous Resonance in Hybrid System with Steam and Wind Turbine by UPFC," International Journal on Technical and Physical Problems of Engineering, vol.4, No. 2, pp176-181, June 2012.
- [5] Naoto Kakimoto & Anan Phongphanphane, "Sub synchronous resonance damping control of Thyristor-Controlled Series Capacitors", IEEE trans on power delivery, Vol.18, No.3, PP 1051-1059, July 2003.
- [6] IEEE Subsynchronous Resonance Working Group: "Terms, definitions and symbols for subsynchronous oscillations", IEEE Trans. Power Appar. Syst., PAS-104, (6), pp. 1326-1334, June 1985.
- [7] G. Maheswaran, Dr. K. Siddappa Naidu, "Comparison of TCSC and SSSC for Damping of Subsynchronous Oscillations in power system", G.Maheswaran et al Int. Journal of Engineering Research and Applications, ISSN: 2248-9622, Vol. 3, Issue 6, Nov-Dec 2013, pp. 1332-1337.
- [8] Rajendra Bhombe, Akhilesh Nimje, "Sub-Synchronous Resonance Control Using Thyristor Controlled Series Capacitor", International Journal of Application or Innovation in Engineering & Management (IJAIEM), ISSN 2319-4847, 2013, pp. 1-7.
- [9] Wan Bo Zhang Yan, "Damping Subsynchronous Oscillation Using UPFC—A FACTS device", IEEE, pp 2298-2301, 2002.
- [10] Ranjit M Zende, Suryakant H Pawar, "Study of Subsynchronous Resonance and Analysis of SSR", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, Issue 7, ISSN:2319-8753, pp 2892-2897, July 2013.

Author Profile



Saira.B.Sheikh receives her bachelor's degree from Nagpur university, Maharashtra, India in the year 2011. She is currently a M.Tech final year student of Abha Gaikwad Patil College of Engineering, Nagpur, Maharashtra, India. Her area of interest are Power system and FACTS device.