

Lyapunov stability-based wide area control systems for excitation boosters in synchronous generators

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Abstract— Excitation Boosters (EB) are aimed to improve Fault Ride Through (FRT) capability of synchronous generators equipped with bus fed static excitation systems by means of adding a supplementary voltage or current source to the rectifier. However, this paper shows that EBs governed by local On-Off controls may result in adverse effects in case of remote faults from generators that may occur in multi-machine systems. To sort this problem out, a novel EB Wide Area Control System (WACS) that modulates the EB voltage using the generator speed deviation with respect to the speed of the Center Of Inertia (COI) is proposed. The speed of the COI is obtained using a Wide Area Measuring System (WAMS), whereas the control laws are deduced from the Lyapunov stability theory. Results show that transient stability of multi-machine systems can be enhanced using EB WACS.

Index Terms— Excitation Booster, Bus Fed Static Excitation System, Fault Ride Through Capability, Grid Codes, Transient Stability, Ultracapacitor, WAMS.

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