IET Renewable Power Generation, vol.9, no.8, pp.1000-1009, November, 2015.

Offline tuning of dynamic settings considering an online central controller in a wind energy harvesting network

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Abstract-

This study aims to define an online reactive power control scheme for a wind energy harvesting network such that it regulates the voltage at the transmission level in a manner comparable to a conventional synchronous plant and hence could be integrated in an existing transmission network hierarchical voltage control scheme. For that purpose, all decentralised elements within the network (wind farms and on load tap changing (OLTC) transformers) should be coordinated. In that sense, a central controller needs to be implemented. Unwanted controller interactions may then arise as the various decentralised controllers dynamically respond to the changing set-points received from a central controller. To mitigate these interactions, this study proposes a novel offline optimisation approach for tuning the dynamic settings (i.e. settings that affect the central controller temporal evolution such as time constant, time delays or dead bands). These settings ensure that the centrally determined set-points can actually be achieved in practice, and unlocking such performance is the principle research contribution of the present study.

Index Terms- power generation control; power transmission control; voltage regulators; reactive power control; voltage control; energy harvesting; optimisation; wind power plants

Citation:
Cuffe, P.; Egido, I.; Keane, A.; Lobato, E.; Saiz, E. "Offline tuning of dynamic settings considering an online central controller in a wind energy harvesting network", IET Renewable Power Generation, vol.9, no.8, pp.1000-1009, November, 2015.