Distributed Generation Control Over Time-Varying Communication Networks in Microgrids

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Abstract

The increasing deployment of microgrids has facilitated integration of renewable energy resources into distribution grids. The deployment resulted in a strategy to mitigate a variety of problems that range from greenhouse gas emission reductions to power grid resilience improvement and from reliability enhancement to provision of low-cost and uninterruptible power supply for mission-critical systems. Although a microgrid has a much smaller physical footprint than the distribution grid, the numerous control design challenges posed appear to be more difficult to address. In contrast with the bulk power grid, microgrids mostly rely on inertialess renewable energy resources interfaced with power electronics. This lack of inertia has raised various concerns about stability and synchronization. The conventional control systems for bulk power grids are implemented using a centralized architecture. However, promising results in the area of distributed control and optimization have encouraged alternative ways to implement the control systems for microgrids. This talk focuses on the design of the distributed controllers to attain the objectives to ensure proportional power sharing and maintain the system frequency at its nominal value in lossy AC microgrids. The proposed controllers are capable to operate over time-varying communication networks, since they are shown to be robust to communication delays and random packet drops.