This research studies the application of intelligent pinning of distributed cooperative secondary control of distributed generators in islanded microgrid operation in a power system. In the first part, the problem of single and multi-pinning of distributed cooperative secondary control of DGs in a microgrid is formulated. It is shown that the intelligent selection of a pinning set based on the number of its connections and distance of leader DG/DGs from the rest of the network, i.e., degree of connectivity, strengthens microgrid voltage and frequency regulation performance both in transient and steady state. The proposed control strategy and algorithm are validated by simulation in MATLAB/SIMULINK using different microgrid topologies. The placement of the pinning node(s) is affected by the topology of the communication network. It is shown that it is much easier to stabilize the microgrid voltage and frequency in islanding mode operation by specifically placing the pinning node on the DGs with high degrees of connectivity than by randomly placing pinning nodes into the network. In all of these research study cases, DGs are only required to communicate with their neighboring units which facilitates the distributed control strategy.

Historically, the models for primary control are developed for power grids with centralized power generation, in which the transmission lines are assumed to be primarily inductive. However, for distributed power generation, this assumption does not hold since the network has significant resistive impedance as well. Hence, it is of utmost importance to generalize the droop equations, i.e., primary control, to arrive at a proper model for microgrid systems. Since the parameters in the network model are unknown or uncertain, the second part of our research studies adaptive distributed estimation/compensation. It is shown that this is an effective method to robustly regulate the microgrid variables to their desired values.

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The public is welcome to attend.