Optimal Distributed Control Methodologies in a Micro Grid

Small scale power system (SSPS) is a collection of sources and loads that shares a common network which can be isolated during terrestrial disturbances. Micro-grids, naval ship electric power systems (NSEPS), aircraft power system and telecommunication system power systems are typical examples of SSPS. The analysis and development of control systems for small scale power systems (SSPS) lacks a slack bus. In addition, a change of a load or source will influence the real time system parameters of the system. Therefore, the control system should provide the required flexibility, to ensure operation as a single aggregated system. In a SSPS most of the cases the sources and loads must be equipped with power electronic interfaces which can be modeled as a dynamic controllable quantity. The mathematical formulation of the micro grid is carried out with the help of game theory, optimal control and fundamental theory of electrical power system. Then the micro grid can be viewed as a dynamical multi objective optimization problem with nonlinear objectives and variables. This research explores the optimal solutions with regards to start up transient modeling, bus selection modeling and level of communication within the micro grids. In each approach a detail mathematical model is formed in order to observe the system response. These mathematical models create the path for designing distributed controllers within the system with local information’s. As a result these models are the keys to developing accurate controllers.

Keywords: Bus selection, Micro grids, Load and source players, Optimal communication, Start up transients

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