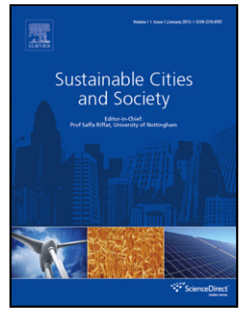
Accepted Manuscript



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PII: S2210-6707(16)30034-8
DOI: http://dx.doi.org/doi:10.1016/j.scs.2016.03.003
Reference: SCS 384

To appear in:

Received date: 9-10-2015
Revised date: 17-2-2016
Accepted date: 6-3-2016

High Stability Adaptive Microgrid Control Method Using Fuzzy Logic

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Abstract

Appropriate control strategies for power sharing between multiple generation units operating in parallel are required to create a stable AC microgrid bus. In this paper, we explore the droop control strategy, implemented by power electronics units, to maintain a stable AC bus voltage without the need for a separate (central) communication layer. In particular, our suggested control method is based on adaptive fuzzy logic control (FLC). Fundamentally in low voltage microgrids, due to the effects of feeder and line impedance, the droop control method is subject to real and reactive power coupling and steady-state reactive power sharing errors, and in particular for complex microgrid configurations, the reactive power sharing poses certain challenges. To improve the reactive power sharing equalization, an enhanced FLC strategy has been utilized to calculate a droop coefficient for reactive power control. A second FLC is implemented in an integrator controller, where the reactive power error has been compensated through the injection of small real power disturbances. Root locus analysis of a representative microgrid with three inverters has been undertaken to confirm that stable solutions are feasible. Implementation of a set of gain values into time domain analysis demonstrates excellent voltage and frequency stability on the main bus, as well as equalized real and reactive power sharing between inverters to within $\pm 5\ W$ and $\pm 10\ VAR$, respectively.

Keywords: droop control, microgrid, power compensation, power sharing.

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Preprint submitted to Sustainable Cities and Society *February 17, 2016*