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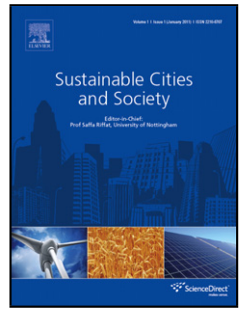

Title: Networked Control of AC Microgrid

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Networked Control of AC Microgrid

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Highlights

- *The paper presents the networked control of AC Microgrid.*
- *A complete model of the Microgrid while considering the time delay.*
- *The stability of the Microgrid under master-slave control strategy with communication delay*
- *is investigated.*
- *Two control networks are investigated, the CAN and the Zigbee. The performance of the*
- *control strategy is test through Matlab simulation and the power sharing is achieved.*
- *A combined master-slave/droop control strategy was implemented.*

***Abstract*— In Microgrids the renewable energy sources are connected through voltage sources inverters in parallel configuration to share the load. In this paper, the networked control of a PV-Based AC Microgrid is presented. The master-slave control strategy is implemented. Two control networks are considered, the CAN and the ZigBee, where the master controller sends the reference currents to the slave converters in the Microgrid. As the control loop contains communication network, the system becomes a networked control system. A stability criterion in the form of Linear Matrix Inequalities based on Lyapunov-Krasovskii functional is used to calculate the maximum allowable delay bound for the system. As the availability of the Zigbee network cannot be guaranteed a combined master-slave/droop control strategy is implemented. Under the wireless control the master-slave control is implemented and in the case of a fault in the network or if the time delay is larger than the maximum allowable delay bound then the controller switches to the droop control. The results are tested through the nonlinear models implemented in the Matlab/Simulink and the TrueTime 2.0 simulator. The performance of the system is good and the current is evenly distributed between the inverters.**

Keywords— CAN; droop; LMI; Low-pass filter; master-slave control strategy; Microgrid; Parallel inverters; Phased locked loop; Time delay; True-time simulator; ZigBee;

I. INTRODUCTION

The ever increased energy demand, the uncertainty in the price of conventional energy sources, and the negative environmental impacts have shifted the focus to the renewable and sustainable energy sources. Renewable energy technologies such as photovoltaic panels, wind turbines, and fuel cells; are among the best renewable energy alternatives. For optimum performance, the renewable energy sources are usually equipped with DC/AC inverters. These inverters are connected in parallel to share the same as shown in Fig. 1. As can be seen from Fig. 1, most of the sources in the Microgrid are renewable energy sources. This parallel configuration is known as the Microgrid (B.Lasseter 2001). The Microgrid concept was introduced by USA's CERTS (Consortium for Electric Reliability Technology Solutions) (K.S.Rajesh et al. 2017). The stochastic and intermittent nature of renewable energy sources prevent their direct connection to the grid. The concept of Microgrid has opened the scope to incorporate renewable energy sources into the conventional grid without a direct coupling with the conventional grid components. This is possible due to the unique feature of the Microgrid, which allows both synchronized grid connected operation and islanded operation in case of instabilities or power outages in the main grid. Integrating many energy sources makes the control of Microgrids very challenging and an active research area, and one of these challenges is the Microgrid control. With the beginning of the fourth industrial revolution and the advances in network technology, the communication networks are promoted as candidates for control signals exchange. Replacing the conventional wiring with wireless network reduces the cost and the energy consumption. Comparing with the direct wiring, the communication network reduces the cost