##### COMPUTATION OF STABLE DELAY MARGIN AND RELATIVE STABILITY REGION FOR NETWORKED MICRO-GRID SYSTEM WITH COMMUNICATION DELAY

**PROJECT REPORT (PHASE II)**

*Submitted by*

**N SWARNALAKSHMI**

**(Register Number: 16EE315)**

*Under the guidance of*

**Dr. K.RAMAKRISHNAN**

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING PONDICHERRY ENGINEERING COLLEGE**

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##### DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**PONDICHERRY ENGINEERING COLLEGE PUDUCHERRY – 605 014**

**BONAFIDE CERTIFICATE**

This is to certify that the Project Work titled **“COMPUTATION OF STABLE DELAY MARGIN AND RELATIVE STABILITY REGION FOR NETWORKED**

**MICRO-GRID SYSTEM WITH COMMUNICATION DELAY”** is a bonafide record work done by **Ms. N. SWARNALAKSHMI (Reg. No. 16EE315)** in partial fulfillment for the award of the degree of **Master of Technology in Electrical and Electronics Engineering (Electrical Drives and Control)** in **Pondicherry Engineering college** and that this work has not been submitted for the award of any other degree of this/any other institution.

**Project Guide**

**(Dr. K. RAMAKRISHNAN)**

**Head of the department (Dr. G. RAVI)**

Submitted for the University Examination held on

**Internal Examiner External Examiner**

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##### ABSTRACT

In micro-grid system, all the distributed generators should be operated and controlled cooperatively to ensure a stable operation with a desirable frequency and voltage profile in the system. For this reason, a micro-grid central controller is generally implemented with a communication network. This introduces time delay in the networked closed loop micro-grid control system. The time delay in feedback loop adversely affects the performance of the closed loop system causing instability.

In first phase of the project, an analytical method is presented to compute the delay margin for stability of networked micro-grid load frequency system. The delay margin was computed for different sets of micro grid central controller gains. In the follow up, the stability region in parametric space of the controller was also determined for a specified Phase/Gain margin and relative stability index.

The main energy source of micro grid system are renewable sources like wind, solar, etc., which are stochastic in nature. This fluctuations may result in loss of the stability. In this aspect, the plug-in-electrical vehicles play a significant role in the stability of the micro-grid system. Hence, in phase II, the stability of a micro-grid load frequency control system with plug-in-electrical vehicles and communication delay is investigated. The micro-grid controller communicates wirelessly with the plug-in-electrical vehicle and they form a kind of delay system. Delay dependent stability analysis is used to derive the stability criterion. The resulting transcendental polynomial enables us to determine the delay dependent stability of the system and sensitivity of root crossing (the imaginary axis) with respect to the time-delay magnitude. The analytical studies will be validated through extensive simulation based experiments by employing a standard benchmark micro-grid system.

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