**Abstract of Ph.D. Thesis**
**" Investigations on Grid Interactive Microgrids with DFIG Based Wind-Solar PV Generation"**
**Mr. Puchalapalli Sambasivaiah (2016EEZ8084), Research Scholar**

## Abstract

This work deals with control and implementation of various microgrid configurations based on wind turbine driven DFIG (Doubly Fed Induction Generator) and solar PV (Photovoltaic) array to power the connected loads with enhanced power quality. It presents standalone DFIG based WPGS (Wind Power Generation System) with a new single input variable fuzzy logic controller (FLC). FLC is applied to both controls of rotor side converter (RSC) and load side converter (LSC) of DFIG to achieve acceptable performance in terms of wind peak power extraction and to regulate voltage and frequency at point of common coupling (PCC) irrespective of wind speeds and load change. Moreover, a battery energy storage (BES) is used at common DC link of RSC and LSC to support wind MPPT (Maximum Power Point Tracking) operation. In addition, the grid-interfaced wind turbine coupled DFIG without BES is investigated for feeding the wind power to the utility grid. Various controls such as adaptive RSC control along with GSC (Grid Side Converter) control, a dual layer least mean fourth (DL-LMF) based control scheme with reduced sensors, and an optimal RSC control, are presented. These controls are developed to achieve wind power extraction, and to regulate the DC link voltage along with power quality aspects such as harmonics elimination, unbalanced load balancing and reactive power compensation. Moreover, an optimal RSC control is proposed to achieve minimal losses in the wind driven DFIG system so that enhanced power is fed to the utility grid. This is done through sharing of reactive power of DFIG between RSC and GSC optimally. Moreover, this work presents grid-interfaced wind turbine driven DFIG with a BES, for which, a novel PLL based control is used to achieve regulated power flow through the grid irrespective of variable winds. Performance of PLL based control is analyzed at grid voltages with DC offset. This microgrid based on wind turbine driven DFIG and solar PV array with seamless transition between islanding and grid connected modes and vice versa, is presented. Seamless transition controls are presented for both RSC and GSC of DFIG to achieve smooth transfer between standalone and grid connected modes. This work presents synchronizing control of wind turbine driven DFIG system with DG (Diesel Generator) set in an isolated microgrid (MG) involving the solar PV array and BES. Modified controls are presented for GSC to achieve minimal fuel operation of DG even at varying loads. Further, grid-interactive wind-solar-DG based MG with BES, is analyzed for enhancing the reliability of power supply. Modified controls are presented for smooth connection of grid/DG. Moreover, various proposed wind turbine driven DFIG and solar PV array based microgrid topologies and their control algorithms, are simulated and verified experimentally at different scenarios such as variable wind speeds, change in connected loads, both in on/off grid/DG modes.