A Novel Integrated Power Quality Controller for Microgrid

Abstract

Introduction:

Distributed power generation has been emerged as a promising option to meet the growing customer needs for electric power with an emphasis on reliability and environmentally friendly renewable energy. In this context, in order to maximize the operational efficiency of the distributed energy resources (DERs) and take full advantage of distributed power generation, as an effective means of integrating DERs into the traditional power grid, microgrid is presented, which can enhance the local customer power supply reliability and system performance, reduce the impact on large power grid, and minimize the system losses. Microgrid has good environmental and economical benefits and has attracted more and more attentions of power researchers. However, the power quality problem of microgrid is much more serious than that of the traditional grid because of the intermittency and randomness of DERs, the high penetration between conventional grid and microgrid, the diversity of DERs, load, energy conversion unit, storage, and operating state. Microgrid power quality has the following unique features compared with the conventional power grid.
**Existing system:**

This method employs an integrator with reset as its core component to control the pulse width of an ac–dc converter so that its current draw is precisely opposite to the reactive and harmonic current draw of the nonlinear loads. In contrast to all previously proposed methods, there is no need to generate a current reference for the control of the converter current, thus no need to sense the ac line voltage, the APF current, and the nonlinear load current. Only one current sensor and one voltage sensor (resister divider) are used to sense the ac main current and the voltage across the dc capacitor. The control method features constant switching frequency operation, minimum reactive and harmonic current generation, and simple analog circuitry. It provides a low cost and high performance solution for power quality control. Steady-state and dynamic analysis is performed that leads to the remedy of the dc offset related to peak current sensing and extension of the stability region.

**Proposed system:**

The novel IPQC can be installed in series and parallel in microgrid or point of common coupling (PCC). For simplicity, the IPQC is installed in PCC. The three-phase detailed system configuration of the IPQC with transformer and inverter. $U_s$ and $L_s$ represent the source voltage and impedance of conventional
power supply, respectively. The passive filters, which have the function of absorbing the harmonics, are shunted in both sides. The primary winding of a transformer is inserted in series between the conventional power utility and the microgrid, whereas the secondary winding is connected with a voltage-source PWM converter. $U_d$ is the voltage of the dc side of the inverter. The microgrid contains a harmonic load, a photovoltaic cell system, a battery storage system, and a normal load.

**Block diagram:**
Passive filters

Input DC supply

12 V DC

3 phase driver circuit

BUFFER circuit

5 V DC

PIC controller circuit

Load

Non linear Load

Filter

Voltage source inverter

Input source 1

Filter

Voltage source inverter

Input source 2
Tools and software used:

- MPLAB – microcontroller programming.
- ORCAD – circuit layout.
- MATLAB/Simulink – Simulation.