Form 3

Abstract

Title : **Voltage Control and Power Management of DC Smart Grid Based on Wind Turbine and Photovoltaic Generation**

(風力発電及び太陽光発電を有する直流スマートグリッドの電圧制御と電力制御)

Recently, the integration of renewable energy sources in form of Distributed Generators (DGs) such as photovoltaic (PV) and Wind Energy Conversion Systems (WECSs) in power systems has increased considerably. This is because it is clean, cheap and abundant in nature. However, since most of the power systems which integrate these renewable generators are those inherited many decades ago, the overall efficiency of power generated due to conversion of generated power is compromising. Moreover, the complicated control systems are required since these renewable resources are not stable in nature while they are integrated to the most stable power system from non renewable resources such as diesel/gas generators.

For that, this thesis proposes the DC smart grid power system (DCSG) for smooth power system operation. Among the advantages of the proposed power system are the DC power generation with less conversion steps, hence the system overall efficiency is significantly increased and power system robustness during weather condition fluctuations. The DCSG power system consists of wind turbine and photovoltaic generators, batteries as controllable loads, DC loads and grid converter.

In the proposed DCSG, different voltage control strategies has been presented and simulated for different operation conditions for DC feeder's voltage stability during the loads and power variations from WT and PV generation. Moreover, the control methods have been applied to the WT and PV generation for maximum power output, and controllable load's and the grid side's dual active bridge series resonant converters (DABSRC) for attaining stable power system. Also, the management of controllable load's state of charge, and power flow management between the grid side and the DC smart grid have been presented.

The operation of proposed power system is analysed in both grid connected and isolated modes. During the grid connected operation mode, the grid connected converter exchanges power between the smart grid and the grid by the use of fuzzy logic control scheme, hence the power system works smoothly. In isolated mode of operation, the coordinated load shedding and dump load schemes are proposed to ensure the stable power supply. The effectiveness of the proposed DC smart grid operation has been verified by simulation results obtained by using MATLAB and Plecs cards.

Name Nassor Thabi Salim