MODELLING OF MICROTURBINE GENERATION SYSTEM USING MATLAB/SIMULINK

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ABSTRACT

Microturbine is one of the Distributed Generation (DG). DG resource is small ranging about ten kW to fractional of MW. Nowadays, enhancement in technology of microturbine has become most promising technologies for small modular installation because desired features such as simplicity in mechanism, compact size, light weight, low emission and ability to operate with a wide range of fuels, as well as combined heat and power possibilities. In order to understand the microturbine's operation, their efficiency model is required. This thesis presents the modelling of microturbine generation system using MATLAB/SIMULINK. Dynamic simulation model of a microturbine was conducted by implementing the SimPowerSystem in MATLAB/SIMULINK. Each component in the microturbine is represented by mathematical model. By using the model, signal analysis is conducted during start-up of the model. The model is conducted in grid-connected mode and islanded mode. The simulation shows the operation of microturbine in both modes.

TABLE OF CONTENT

CHAPTER 1

INTRODUCTION

1.1 Overview

Demand for renewable energy technology such as wind turbine, photovoltaic and small hydro electric turbine and also gain resource range from conventional technology such as diesel engines to emerging technologies such as microturbines or fuel cell have become common because the technology of distributed generation (DG) system is advancing due to research and development progression in order to improve the existing power generation system. DG contributes high efficiency of the energy conversion process and cleanliness, better than existing power plants with small ranging system where less than 100MW in capacity and connected directly to grid at distribution level voltage or on the user side. Moreover, DG is installed near the consumers to reduce the amount of energy lost in transmitting electricity and size and number of power lines that must be constructed. DG can also be extended to heat and co-generation. Utilization of DG into distribution system affects the system dynamic operation, reliability, power quality, stability and protection [1]. Those parameters should be considered during design stage to sustain reliability.

Nowadays, microturbine technology has become most preferable power generation systems. Microturbine has power level ranging between 25 to 500 kW and operates with higher frequency between 1500 Hz to 4000 Hz higher than conventional gas turbines. The operating frequency is high and makes microturbine moving with higher speed ranging from 50000 to 120000 r.p.m.. Microturbine can operate using variety of fuels including natural gas, sour gases (high sulfur, low Btu content), and liquid fuels such as gasoline, kerosene, and diesel fuel/distillate heating oil to produce electricity and more efficient than gas turbines while keeping low emission [1-4]. There are two types of microturbine, one with single shaft and the other one with split shaft.