

PEM FUEL CELL BASED DISTRIBUTED GENERATION MODELING AND INTERFACING

Zhong Bing, Mike Shen, Ehab El-Saadany

*Electrical and Computer Engineering Department
University of Waterloo
200 University Avenue West, Waterloo, Ontario N2L 3G1, Canada
Phone (01) 519/888-4567, Fax (01) 519/746-3077
E-mail: zbshen@engmail.uwaterloo.ca*

Keywords: control strategy; distributed generation; DC/DC converter; DC/AC inverter; interfacing; modeling; PEM fuel cell; simulation; topology

ABSTRACT

Fuel cell based distributed generations have been receiving more attention in the last years because of their high efficiency, low aggression to the environment, no moving parts and superior reliability and durability. In particular, PEM fuel cells seem to be a good option to be implemented as a Distributed Generation (DG) in distribution systems. In this paper, one dynamic PEM Fuel Cell (PEMFC) model is constructed using electrical circuits in PSCAD/EMTDC simulator. In this model, the double-layer charging effect and the thermal characteristic inside the fuel cell are both integrated into the model. This fuel cell model is a very important part of the whole fuel cell DG model. For the interface designs, a novel DC/DC boost converter with a 1-phase; 3-winding high frequency transformer is designed. This novel DC/DC topology provides the fuel cell DG systems with several distinguished advantages. In addition, one 3-phase; 4-wire DC/AC SPWM inverter is also designed in order to connect the fuel cell DG to the AC loads and/or the utility grid. Moreover, proper control strategies are also designed for interface operations.