Investigation of Power Transfer in QAB Converter via Phase Shift Modulation

Suliana Ab Ghani[1] , Hamdan Daniyal[2] , Nur Huda Ramlan[3] and Meng Chung Tiong[4]

FKEE, University Malaysia Pahang
26600 Pekan Pahang, Malaysia
[1]suliana@ump.edu.my
[2]hamdan@ump.edu.my
[3]hudaramlan@ump.edu.my
[4]tiongmengchung@hotmail.com

Abstract. In line with high demand of renewable energy as well as the energy storage, the multiport DC-DC converters topology have recently received a lot of attention due to its own advantages. In this paper, a bidirectional quad active bridge (QAB) DC-DC converter with high frequency transformer is presented. Full bridge power converter is employed and the phase shift modulation is used in investigating the power transfer of QAB converter. In applying this proposed modulation, the changing or amount of delivering and receiving power in the QAB converter are influenced by the phase shift. Multiple cases of QAB configuration have been evaluated by 1) Multi-input single-output (balanced voltage source); 2) Multi-input single output (unbalanced voltage source); 3) Multi-input multi-output (balanced voltage source); and 4) Single-input multi-output (unbalanced load). The simulation results of a 2.5 kW system is analyzed through MATLAB/Simulink. Also, the power efficiency is discussed through this simulation. It is found out that maximum power can be achieved at 90° phase shift.

Keywords: Quad active bridge, Bidirectional power flow, Phase shift modulation.

1 Introduction

Nowadays, the attention towards the assimilation of renewable energy (RE) such as photovoltaic (PV) and wind turbine with the energy storage have become increasing. Due to the high needed of the interfacing of various energy sources and load either with multi input or multi output , the multiport converter have been applied by interconnection through a common DC bus [1]. This conventional method consume more conversion stages due to separate converter for individual sources or load and the limited of voltage range [1] [2]. Besides, as reported in [1], the other methods for instance the time sharing concept only applicable for low power and unidirectional power flow.