

Proposed PV Transformer-Less Inverter Topology Technique for Leakage Current Reduction

M.N.H. Khan¹, M.H. Delwar², Md. A. Kabir³, M.S. Zahan⁴, K.J. Ahmad⁵, M.M. Alam⁶, M. T. Anower⁷
^{1,2,3,4,6,7}Dept. of Electrical and Electronic Engineering, Uttara University (UU), Bangladesh

⁵ Electrical and Computer Engineering, International Islamic University Malaysia, Kuala Lumpur, Malaysia

Article Info

Article history:

Received Nov 12, 2015

Revised Apr 6, 2016

Accepted May 7, 2016

Keyword:

Filter

Leakage current

Photovoltaic (PV) panel

Pulse width modulation (PWM)

Transformer-based inverter

Transformer-less inverter

ABSTRACT

Importance and demand of using renewable energy is dramatically escalated globally. Hence, the use of renewable energy is going to touch in peak. This demand is varying according to the site choosing. For instance, Wind is preferable where air is following highly as well as solar recommended place is high sun ray reducing places. Especially, the renewable system is highly recommended for electrification issues where it's possible to produce the electricity for fulfilling rural and remote areas electricity problem. The photovoltaic (PV) panel of connecting with transformer based system is popular where some limitations are occurred especially cost and weight. In contrast, in this paper is focusing these issues where the transformer-less inverter system is used. Here will discuss some transformer-based and transformer-less inverter topologies and the leakage current issue which is occurred when transformer-less inverter system is used. Moreover, here is proposed a topology for reducing the leakage current after doing switching technique in both 50% and 75% duty cycle where output voltage remains quite same.

Copyright © 2016 Institute of Advanced Engineering and Science.
All rights reserved.

Corresponding Author:

M. N. H. Khan,

Dept. of Electrical and Electronic Engineering, Uttara University (UU),

House-4 & 6, Road-15, Sector-6, Uttara Model Town, Uttara, Dhaka-1230.

Email: nomanxp76.eee@uttaraUniversity.edu.bd, nomanxp76@gmail.com

1. INTRODUCTION

To generate the electricity the most uses sources are coal, oil and natural gas where these sources actually the main causes pollution our environment [1] as well as those source are diminishing rapidly. To make our environment friendly, today's most important energy is renewable energy such as hydro, solar, wind, bio-mass and so on [2-4]. The Photovoltaic (PV) panel is becoming a very part and parcel due to electricity production. PV system to produce electricity needs inverter which is establishing interfaces between the PV-panels and the utility-grid for decreasing the cost and reducing power loss [1, 5]. The most solar-to-grid connections in the single-phase inverters which are followed by single-phase transformer. The use of transformer, although helps in providing for galvanic isolation between the PV panel and the grid, leads to increase in loss of power, and hence loss in revenue. Although compensating considerably for the issues of cost and size, transformer-less topologies result into increased leakage current due to coupling and parasitic capacitances [5, 6]. These leakage currents form their paths through the way of low-pass filter (LPF) elements (used for AC wave-shaping) and the exterior grid-network back to earth because of developed common mode problems which may reason of varying in voltage. In the common-mode issues of the system, a voltage which is generated around the parasitic capacitor helping the inverter to produce leakage current, causing to produce even electric shocks. Hence, the common mode voltage variations, the very reason for leakage currents, is to try using different approaches in newly reported topologies aimed at minimizing these currents. Another approach by same authors in [7] suggests a multi-stage single-phase converter of a