DESIGN AND SIMULATION OF TESLA COIL AS A RESONANT TRANSFORMER

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FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
MALAYSIA

MOHD FAIZAL BIN TALIB
Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MARA
40450 Shah Alam
Selangor Darul Ehsan

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ABSTRACT

Nikola Tesla is the responsible person that invented Tesla Coil, a type of resonant air cored transformer, used to generate high voltage and low current electricity. Even though the Tesla Coil is an old invention, there are useful for developing many devices today. The Tesla Coil is used to conduct innovative experiments in electrical lighting, fluorescence, x-rays, wireless energy transfer for electrical power transmission and also for educational purposes. Tesla coil designs employed high voltage alternating current power source, high voltage capacitor, and a spark gap to excite the primary side of the Tesla coil system with periodic bursts of high frequency current. The primary and secondary coil is designed in order to resonate at the same frequency. Thus, this paper presents to design and simulate the Tesla Coil as resonant transformer using low direct current (dc) voltage as primary input instead of alternating current (ac) voltage and will produce an ac high voltage at secondary circuit side. This project will prove that even though the input is only a low DC voltage, the Tesla Coil will be able to step up the input voltage and simultaneously generate a high voltage approximately 2kV at the secondary side by the simulation.

Keywords - Tesla Coil, Low DC voltage, High AC voltage.

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INTRODUCTION

1.1 OVERVIEW

A Tesla coil is a type of resonant transformer circuit used to produce high voltage, low current, and high frequency alternating current electricity. A transformer is a device used to transfer electric energy from one circuit to another, especially a pair of multiple wound, inductively coupled wire coils that effect such a transfer with a change in voltage, current, phase, or other electric characteristic. Although the Tesla Coil uses the same concept as a transformer, there is a difference between them. The transformer normally uses metal as a core while Tesla Coil only uses the air its core with loosely windings around 10% to 20% from primary to secondary [1]. In general, the output of Tesla Coil does not depend on its turn's ratio but it depends on the relative ratio of capacitances or inductances to produce high voltage.

The early Tesla Coil design employs a medium- to high-voltage power source. Due to the large size of the Tesla Coil, it is usually built in a fixed area that remains difficult to be removed. In addition, the high voltage input of Tesla Coil is quite dangerous to the users and this research attempts to make an innovation to the typical Tesla Coil with low voltage as the input supply.