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Jai Gopal Pandey, CEERI Pilani Rajasthan

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LLC Resonant Converter Design for Fast Charging of Electric Vehicles

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Abstract

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- I. Introduction
- II. Proposed Techniques of LLC-RC and Its Methodology
- III. Experimental Results
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Abstract:

Charging the batteries of electric cars (EVs) is the primary problem because electric vehicles (EVs) are becoming the primary mode of transportation all over the globe. While simultaneously charging batteries at a high rate, the electric vehicle charger can flexibly make voltage adjustments over a wide range. By finding a balance between efficiency and gain range, it is difficult to optimize inductor-inductor-capacitor (LLC) converters in a way that is both efficient and effective. Inductances that are resonant and magnetizing are going to be included in the LLC converter. It is possible to make dynamic adjustments to the magnetically attracting inductance depending on changes in the load and the electrical output voltage. A switch-controlled magnetic inductor (SCMI) that is connected in parallel with the secondary side winding of the converter transformer is used to achieve the desired correction. Fast-charging electric vehicles (EVs) increase efficiency by up to 96.4%, minimizing energy waste. The proposed converter's power density makes it small and space-efficient enough for fast-charging stations. Electric vehicle charging is fast with the suggested converter, which can give up to 800 watts of electricity from 80 V to 100 V under different dynamic conditions. To validate the essential concepts, a functional prototype of the whole LLC-RC bridge, as described.

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I. Introduction

Currently, environmental contamination and air pollution are significant worldwide concerns [1]. Specifically, conventional vehicles powered by both diesel and petrol are the main contributors to respiratory and environmental pollution, mostly due to the pollutants they emit. Consequently, there is a growing need for environmentally friendly electric vehicles. The percentage share of the worldwide automobile market occupied by electric vehicles (EVs) and low-emission vehicles is consistently expanding [2]. Furthermore, electric vehicles (EVs) have the benefit of reduced servicing requirements and lower noise emissions as compared to gasoline- or diesel-powered cars [3]. On the other hand, they need quite a lengthy amount of time to charge. For this reason, it is of the utmost importance to build electric automobiles that have a shorter charging time. In recent times, there has been a focus on enhancing the power of rapid fast charging technologies [4]. To state it another way, boosting the power implies raising the voltage or current levels and vice versa [5]. When the voltage is increased, there is a difference in the electric potential between the converter's output voltages and the voltage produced by the battery [6]. As a result, the charging current is increased. High-efficiency converters and quick charging topologies are the subject of a significant amount of research that is now being conducted for the electric vehicle charging system.

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