Wireless Charging System using FSK for Bidirectional Communication between Input and Output Circuit

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Abstract

Several portable electronic devices (which include laptops, cellular phones, virtual cameras, and electric shavers) rely on rechargeable batteries and need to be robotically charged by way of the line electricity. A wireless charging technique able to handing over electromagnetic power to those transportable devices could cause them to tether unfastened and “sincerely transportable.” Wi-Fi charging is specifically valuable for gadgets with which stressed out connections are intractable. Recently the wireless transmission of energy has been a completely energetic subject matter of research as has interest inside the electrification of small gadgets like mobile, pc charging machine wireless electricity switch (WPT) is based totally on a generation called magnetic resonance coupling. two copper coils are tuned to resonate at the same natural frequency. The coils are located some feet apart (as shown in Fig.1). One coil is hooked up to an electric powered present day, which generates a magnetic area that reasons the second one coil to resonate. This magnetic resonance outcome in the switch of electrical strength thru the air from the first coil to the receiving coil. The resonant circuits themselves need to have a excessive Q-element to allow for the excessive cutting-edge operation of the system. Wireless charging structures were advanced by way of the use of high frequency wireless planar transformers (HFWPTs), based on exceptional systems like fractal, circular and rectangular designs which may be used to price any transportable devices without any direct physical connection. HFWPT allows an electricity switch using inductive coupling, which could help to, triumph over touch failure troubles, emerge as handy, and person friendly every other gain of this layout is to help in development of mild-weight, small sized and fantastically green excessive frequency chargers for portable gadgets inclusive of mobile phones and notebook desktops.

Keywords: Inductive energy transmission, rectifiers, DC-DC power converters, reactive electricity control, impedance matching, segment-shift control, wireless charging

I. INTRODUCTION

WPT machine is introduced and the theoretical conditions for calculating the maximum efficiency and the maximum strength transfer are furnished. The proposed concept is applicable to each topology. The sinusoidal voltage supply VIN is an equivalent Root suggests rectangular (RMS) enter voltage that's driving the primary side resonance circuit. The collection resistances Rp and Rs represent the overall parasitic resistances of the number one and the secondary facet resonance circuit. The series capacitors Cp and Cs are required to song the resonance frequency of the number one and the secondary side, even as the mutual inductance M depends at the coupling aspect k = Mp Lp Ls, that is motivated through the geometry, the space, and the alignment of the inductors Lp and Ls. The open circuit impedances of the primary and secondary side resonance circuits are defined as \[ Z_p = R_p + jX_p = R_s + jX_s. \]

A. Efficiency and Extractable Power:

So as to research the device overall performance, the input and output power of the WPT machine are derived as a characteristic of the resistive part RL and the reactive component XL of the equivalent load impedance. This approach is referred to as unmarried-factor efficiency optimization within the following, since it maximizes the efficiency best for a single cost of the output power which can be far from the maximum output electricity of the machine. If the output electricity is various with the aid of altering the load resistance RL, the performance decreases and the machine does now not operate at the surest performance for this particular value of the output electricity. It’s miles really worth noting that the conditions \( (RL = RL_{opt}, XL = X_s) \) for optimum efficiency, and \( (Zin = Zo) \) for optimum energy transfer are in trendy now not fulfilled at the equal time. To triumph over those drawbacks and to attain superior efficiency for every feasible cost of output strength, an optimization method is needed to regulate each the resistive and the reactive part of the equivalent load impedance.
B. Proposed Concept:
In this segment synchronous rectification is briefly reviewed and, thereafter, the proposed idea for controlling the equal load impedance to optimize the efficiency and to boom the electricity transfer functionality is mentioned in element. Simulation consequences are shown for a WPT device based on the Qi low energy specifications, operating at a frequency of a hundred and forty kHz with a resonance frequency of a hundred kHz.

C. Synchronous Rectification:
Synchronous rectification is a generally used approach to govern an active rectifier, wherein the switches of the full bridge are pushed in keeping with the zero crossings of the rectifier input contemporary IL. consequently, the controller forces the modern-day IL and the voltage VL at the center of the rectifier to be in segment (‘ = zero), which ends up in a only resistive behavior of the rectifier the possibility to improve the performance of a WPT machine with the aid of introducing a section-shift between the primary and secondary facet voltages. but, this approach does now not permit to one at a time manage the resistive and reactive part of the equal load impedance, while within the proposed idea the overall impedance is controlled. By defining the phase-shift ‘ as the angle among the primary harmonic of the enter present day IL and the voltage VL of the active rectifier we derived an analytical expression for the equivalent enter impedance of the active rectifier.

D. Optimization Strategy:
On this segment two methods to reap the maximum performance for a favored amount of output energy are offered. The first method is based on the numerical optimization of the performance for a given output energy the use of the resistive and reactive part of the equivalent load impedance. because it isn't always simple to attain the values of RL and XL in the course of consistentnation, a second optimization technique is added, wherein the rectifier input contemporary IL is optimized as a feature of the segment-shift ‘ and the rectified voltage Vr. those two measurable parameters can be used to attain the maximum performance of the device for each fee of the output power. It’s far worth noting that each presented optimization strategies yield the same overall performance.

After designing and enforcing of proposed method with grid-linked solar photovoltaic system there could be some expected end result:
1) Proper response for power delivery into the gadget.
2) 2. Resonance is acquired for maximum electricity transfer in system
3) 3. Predicted efficiency 86%.

E. Circuit Diagram:

Fig. 1: Simulink model of the overall WPT
F. Result:

![Output of the simulink model](image_url)

After designing and implementing of proposed method with grid-connected solar photovoltaic system there would be some expected result:

1) Acceptable response for power delivery into the system.
2) Resonance is obtained for maximum power transfer in system
3) Expected efficiency 86%.

REFERENCES


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