Wireless Inductive Power Transfer

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ABSTRACT

The inductive power transfer (IPT) system is introduced with the reduction of conversion stages by using the matrix converter this system have high reliability and very long lifetime. This matrix converter has reduction of switches compared with regular converter which can operate without any losses, this converter reduces the switching stress switching losses and electromagnetic interference of the converter, the resonant current and resonant voltage can be regulate by this IPT using matrix converter. In this converter the switches will operate on reverse blocking mode except seventh switch this will operate as a normal or regular switch. The number of switches are also reduced as seven due to this the reliability also can increase accordingly. The efficiency of the converter will increase and cost of the converter also reduce accordingly. This proposed converter has various operating modes (eight modes), by using this IPT system affecting from the pollution, dust and electric shock can be eliminate so totally this method is very compact for transferring the power and simple and effective method.

Keyword: - *AC-AC converter, inductive power transfer, matrix converter and soft switching.*

1. Introduction

The inductive power transfer system has introduced to simply the life with technology and to move technology for next generation of our life. Inductive power transfer technology is one of the best method to transfer the in effective manner. This IPT system is mostly used to transfer the power without any physical contacts with different frequency and resonant current, this technology is free from pollution so it is the one the environment friendly method. It will not affected by dust, sparking and shock so it has high reliability compared with any other method this can be the more effective. (1) (2) In this paper to reduce the conversion stage we introduced the matrix converter with the help of this the efficiency also can increase and we can control the resonant current as well as. This IPT method has been employed in mobile phone charging, laptop charging, electric vehicle, electric tooth brush and smart cards. For transferring purpose we need ac supply because in dc there is absence of oscillation this can't able to create an oscillating magnetic field. Due to that the power can transfer primary to secondary.

1.1 Voltage source inverter

Voltage source inverter (VSI) has used to convert the current one form to another form such as from AC to DC with the effective and power loss method, this voltage source inverter works with pulse with modulation (PWM) But in proposed system this can be altered by the fuzzy logic micro controller this can provide the accurate output power which is according to our need.

1.2 Wireless Power Transfer (WPT)

Wireless power transfer system is used to transfer the power one device to another device through the air medium or intervening space by inductive coupling or capacitive coupling, we know that in inductive coil magnetic field will produce and in capacitive coil electric field will produce. In wireless power transfer system there are two main system consist which is called transmitting or primary coil and another one is receiving or secondary coil. So in wireless power transfer system instead of wire air medium or electric field/magnetic field takes place. Due to the supply voltage the coil which made by copper becomes magnetizing and it produce electromagnetic field, depend upon that magnetic field strength, the amount of power can transfer from primary side to secondary side. In wireless power transfer dc can't transfer in the coils because there is absence of oscillation in dc, so ac is commonly used for power transfer system or some converters can be used for this situation. In this system there are two types mostly can use one is non-radiative and another one is radiative transmission system.

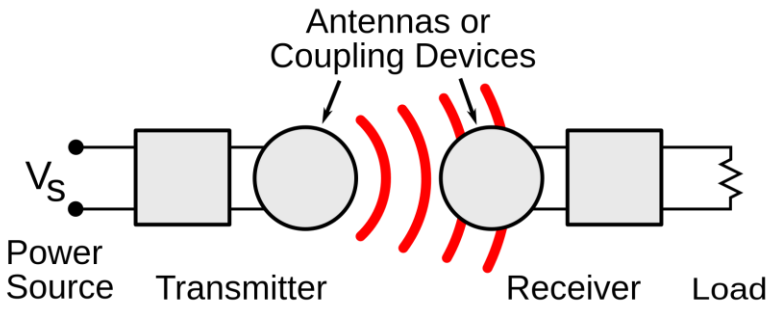

Fig -1: Block diagram of wireless power transfer system

1.2.1 Radiative

In this radiative method the field of the magnetic or electric are perpendicular to each other, so the radiative method is used for transferring the power by electric field or magnetic field by inductive coils or capacitive coils. The radiative power transfer system efficient for long range transmission system. So this power transfer system mostly used in electric toothbrush, electric vehicles, smart card and chargers.

1.2.2 Non-radiative

In this non-radiative power transfer system the field of the electric or magnetic are not perpendicular to each other, so the transferring by inductive coupling and capacitive coupling. This non radiative method is used in only short range distance. If the air medium of the coupling increase then power can't transfer so it fully depend upon the antennas diameter.

2. Inductive coupling

In the inductive coupling the power is transferred in between two coils, the inductive coupling is works similar as transformer. While transmission, an alternating current creates oscillating magnetic field in primary or transmission coil, according to the faraday's law EMF induced in secondary or receiving end due to the oscillating magnetic field, then after its creates an alternating current in receiving end, that received current can used directly to load or after converting, it can stored in either that can used for dc load.

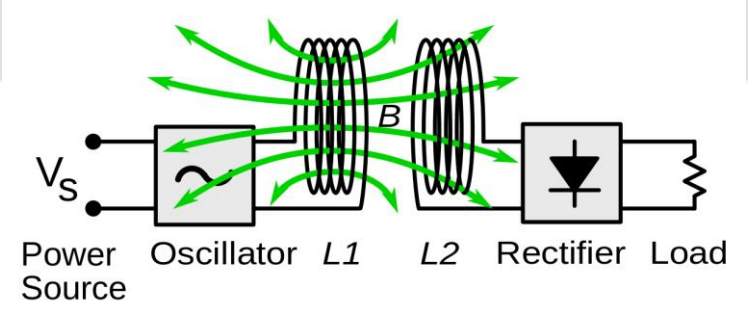

Fig-2: Inductive wireless power system

The inductive coupling mostly used in electric motors, transformers, metal detector, radio frequency identification and wireless power transfer system. (3) Like this there are various types of coupling is there such as resonant inductive coupling, capacitive coupling, and magneto dynamic coupling.

2.1 Resonant inductive coupling

Resonant inductive coupling is also like inductive coupling, it transfers the power from primary coil or transmitter coil to secondary or receiver coil. There is two coil is there in between that only our resonant coil has placed.

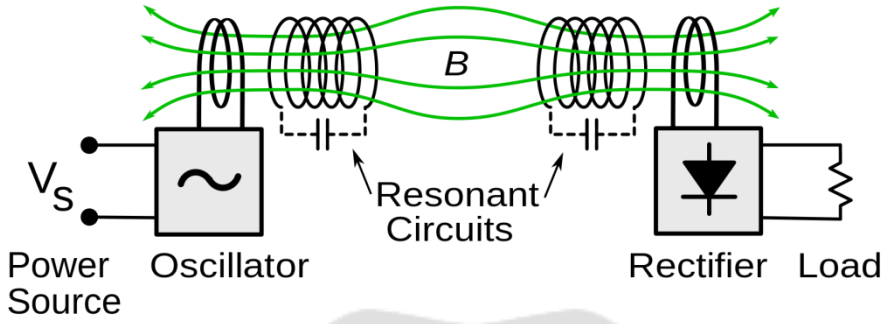

Fig-3: Resonant inductive wireless power system

Both coil consist of resonant circuit in between them that we can see by below diagram, with that primary and secondary resonant coil capacitor will connected separate, (4) it helps to increase the coupling and power transferring capacity. By above diagram we can see oscillating magnetic field which is cutting by secondary resonant coil due to that EMF producing in secondary coil. The transferred current can be converted as per our requirement that can be shown in above diagram.

2.2 Capacitive coupling

The capacitive coupling has two metallic plates or electrode this can considered as a primary or transmitter and secondary or receiver. The alternative current creates the oscillating magnetic field as per the electromagnetic field has cut by the secondary plate or electrode, due to this process EMF has produced. This capacitive coupling also simple and effective power transferring method.

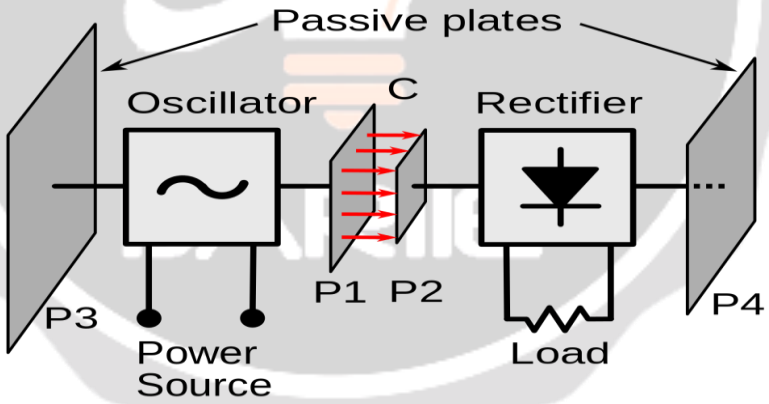

Fig-4: Capacitive coupling power transfer system

In this capacitive coupling method there are two types commonly introduced based on coupling, one is unipolar coupling and another one is bipolar coupling. In above diagram we can observe the unipolar type coupling this also one type of effective power transfer method.

2.3 Magneto dynamic coupling

Magneto dynamic coupling is nothing it is also one of the power transferring method from primary to secondary, here two rotating armature has used as a primary or transmitter and secondary or receiver. (5) When the speed of an alternator reach to synchronous the both armature will get coupled due to the magnetic field which is produced by permanent magnet in armature, by this coupling the power can transferred from primary to secondary, so this method also can be used as an alternative for inductive coupling.

3. Matrix converter

Basically during the transmission process the supply supposed to convert one form to another form according to the requirement, so for conversion process and also to simplifying the stages of conversation, here matrix converter used as an alternative process. We know that matrix converter converts the ac source into ac source which means ac-dc-ac, with different frequency and amplitude. Basically matrix converter has nine switches but here for simplifying the conversional stages and reduce the cost, seven switches only we are using in this paper. Six switches are reverse blocking switches and remaining seventh one is regular switch.

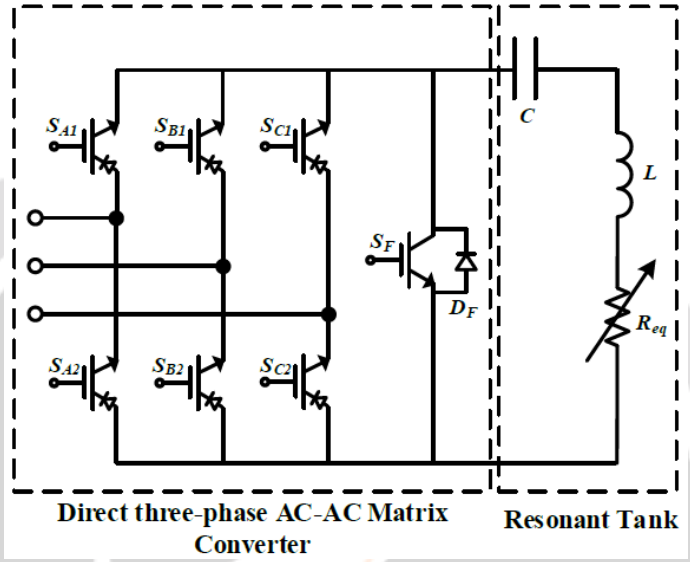

Fig-4: Three phase matric converter

The regular switch has connected parallel with the resonant tank which is shown in the bellow diagram, by using this matrix converter we can control the resonant current, resonant voltage and output power. In this project IGPT is used as a switches. In this matrix converters resonant tank is used for reduce the harmonics from the circuit. In this matrix converter there is various regulating modes are there, each phase has two switches when one switch got energized then another switch will be in un-energized mode. So accordingly there is eight regulating mode are presented. The seventh switch is used for regular switching purpose, this seventh switch will get energized for positive half cycle of the resonant current, the modes from 1 to 6 used for get a input line from the three phase, the parallel operation of the switches can decide the positive half cycle resonant current and negative half cycle resonant current this all depends upon the modes of operation. (6)

4. CONCLUSIONS

This paper has introduced the inductive power transferring system which has reduced the conversional stages by using three phase ac-ac matrix converter. Because of this matrix converter the resonant voltage, resonant current, and power can be controlled as well as. So this power transferring method is simple, user defined and effective method to transfer the power one device to another device. And in this paper various types of coupling are explained which can be used for effective power transferring method.

Compared with regular matrix converter here the number of switches are varied, normal matrix converter has nine switches but in this paper we have introduced seven switching operation so by this cost can be reduced mean while efficiency also becomes 85%-90% compared with any other power transferring method.

5. REFERENCES

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