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# Wireless Power Transmission Using Inductive Coupling

Dikkala Sushma, Dr.N. Prema Kumar

PG Student, Department of EEE, Andhra University College of Engineering, Visakhapatnam, India

Professor, Department of EEE, Andhra University College of Engineering, Visakhapatnam, India

**ABSTRACT:** Wireless power has been a topic of interest from the early 20th century until today. This paper traces the history of wireless power transmission starting with Nikola Tesla, continuing on to experiments with beaming power using microwaves. Examining the difference between near-field and far-field techniques, this paper continues into modern times explaining why near-field technique is more suitable for consumer electronic devices and exploring the near-field transmission of power via the magnetic field. Examples of short-range and midrange wireless power systems are explored. In existing era every single person desires wireless system, but stagnant power transmission for low power device we are using wired device continuous power supply is one of the major issues in the purpose of the application of wireless sensor network. For the WPT, we had better concentrate power to receiver. It was proved that the power transmission efficiency can approach close to 100%.

**KEYWORDS:** wireless power transmission (WPT), near field techniques, far field techniques, magnetic field.

## I. INTRODUCTION

Wireless Power Transmission (WPT) is the efficient transmission of electric power from one point to another through vacuum or an atmosphere without the use of wire or any other substance. This can be used for applications where either an instantaneous amount or a continuous delivery of energy is needed, but where conventional wires are unaffordable, inconvenient, expensive, hazardous, unwanted or impossible. The power can be transmitted using Inductive coupling for short range, Resonant Induction for mid-range and Electromagnetic wave power transfer for high range. WPT is a technology that can transport power to locations, which are otherwise not possible or impractical to reach. Charging low power devices and eventually mid power devices by means of inductive coupling could be the next big thing.

The objective of this project is to design and construct a method to transmit wireless electrical power through space and charge a designated low power device. The system will work by using resonant coils to transmit power from an AC line to a resistive load. Investigation of various geometrical and physical form factors evaluated in order to increase coupling between transmitter and receiver.

## II. TESLA'S EXPERIMENT

Tesla demonstrating wireless power transmission in a lecture at Columbia College, New York, in 1891. The two metal sheets are connected to his Tesla coil oscillator, which applies a high frequency oscillating voltage. The oscillating electric fields between the sheets ionizes the low-pressure gas in the two long Geissler tubes he is holding, causing them to glow by fluorescence, similar to neon lights. Experiment in resonant inductive transfer by Tesla at Colorado Springs 1899. The coil is in resonance with Tesla's magnifying transmitter nearby, powering the light bulb at bottom. Inventor Nikola Tesla performed the first experiments in wireless power transmission in wireless power transmission at the turn of the 20<sup>th</sup> century, and may have done more to popularize the idea than any other individual. In the period 1891 to 1904 he experimented with transmitting power by inductive and capacitive coupling using spark-excited radio frequency resonant transformer, now Called Tesla coils, which generated high AC voltages. With these he was able to transmit power for short distances without wires. In demonstrations before the American Institute of Electrical Engineers and the 1893 Columbian Exposition in Chicago he lit light bulbs from across a stage. He found he could increase the distance by using a receiving LC circuit tuned to resonance with the transmitter's LC circuit, using resonant inductive coupling. At his Colorado Springs laboratory during 1899-1900, by using voltages of the order of 10 megavolts generated by an enormous coil. he was able to light three incandescent lamps at a distance of about one hundred feet. The resonant inductive coupling which Tesla pioneered is now a familiar technology used throughout electronics and is currently being widely applied to short-range wireless power systems.[1]

**III. BASIC CONCEPT OF WIRELESS POWER TRANSFER:**

**1) Inductive Coupling:**

Inductive or Magnetic coupling works on the principle of electromagnetism. When a wire is proximity to a magnetic field, it generates a magnetic field in that wire. Transferring energy between wires through magnetic fields is inductive coupling.

If a portion of the magnetic flux established by one circuit interlinks with the second circuit, then two circuits are coupled magnetically and the energy may be transferred from one circuit to another circuit.

This energy transfer is performed by the transfer of the magnetic field which is common to the both circuits.

In electrical engineering, two conductors are referred to as mutual-inductively coupled or magnetically coupled when they are configured such that change in current flow through one wire induces a voltage across the end of the other wire through electromagnetic induction. The amount of inductive coupling between two conductors is measured by the ir mutual inductance. Power transfer efficiency of inductive coupling can be increased by increasing the number of turns in the coil, the strength of the current, the area of cross-section of the coil and the strength of the radial magnetic field. Magnetic fields decay quickly, making inductive coupling effective at a very short range.[2]

**2) Inductive Charging:**

Inductive charging uses the electromagnetic field to transfer energy between two objects. A charging station sends energy through inductive coupling to an electrical device, which stores the energy in the batteries. Because there is a small gap between the two coils, inductive charging is one kind of short- distance wireless energy transfer.

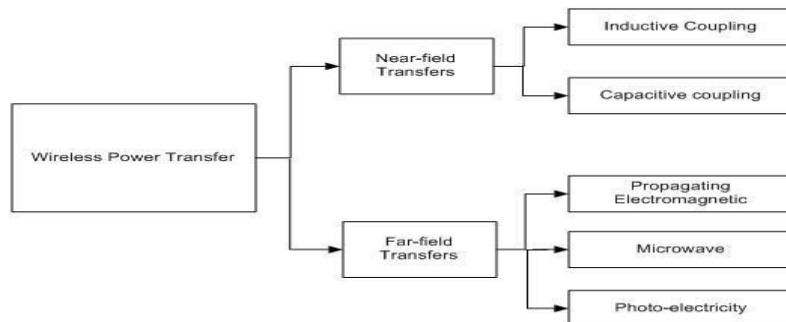
Induction chargers typically use an induction coil to create an alternating electromagnetic field from within a charging base station, and a second induction coil in the portable device takes power from the electromagnetic field and converts it back into electrical current to charge the battery. The two induction coils in proximity combine to form an electrical transformer.

Greater distances can be achieved when the inductive charging system uses resonant inductive coupling.

**Main concepts of wireless transmission of electric energy:**

Every electromagnetic source creates both electric (**E**-fields) and magnetic (**H**-fields) fields around itself, and they are characterized by the radiative and non-radiative components. Depending on the distance from the source there are near-field, transition and far-field regions that are defined by the way they interact with the surrounding media. The small transition region has both the characteristic of near-field and far-field.

The situation when the distance to the source is less than  $\lambda/2\pi$  is near-field. Near-field has a complex definition in terms of relation between **E** and **H**, but more importantly, it has all four types of polarisation present (horizontal, vertical, circular and elliptical), while far-field has only one type. A striking point is that a near-field region is a better environment for electromagnetic induction than far-field, where electric and magnetic fields decrease proportionally to the distance.



**Figure 1: Types of WPT**

A near-field region allows higher power transfer efficiency and diffraction of the wave, which results in stronger penetrability and weak directivity on a short range. In addition, near-field transfer is divided into inductive (magnetic) coupling and capacitive (electrostatic) coupling. Capacitive coupling of two conductors is achieved via transfer of electric energy through dielectric media. However, inductive coupling is based on alternating magnetic field and considered to be more secure and productive for wireless power transfer. Figure 1 denotes the main WPT methods which were developed historically.

Apparently, since far-field power transmission methods are not practical, due to weak penetrability, low efficiency and uncertain safety, the industry is more interested in the near-filed region. A typical near-field wireless power transfer system consists of several blocks (Figure 2). In most cases it is represented as strongly coupled primary power

transmitter (TX) and secondary power receiver (RX) units separated by 1 to 10 cm. The transmitter transforms DC to AC energy and couples it to the receiver via a coil or antenna. Firstly, there is a conversion from DC to AC at a set frequency (commonly several hundred kilohertz) in the inverter unit, which is usually a high-efficiency switching circuit. This circuit especially plays a vital role on the transmitter side since it decides the overall efficiency of the system. Since the wavelength is relatively large compared to the distance between TX and RX, it is clearly a near-field system according to Figure 2. [2]

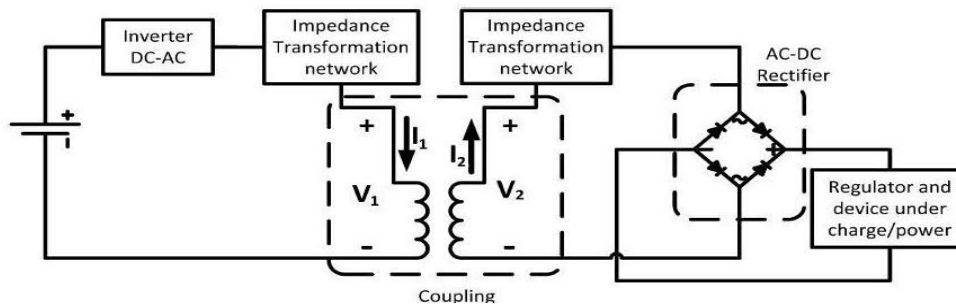


Figure 2: Typical near-field transfer system structure.

### Wireless Power Transfer (WPT):

Wireless power transmission, also known as inductive power transfer, can be used for short range or even long range without cords. This technology provides efficient, fast, and low maintenance cost as compared to previous technologies. It also allows portable electronics to charge themselves without ever being plugged in ubiquitous power wire. On the other hand, power loss of this technology is very less as compared to wired electricity transmission. The main function of wireless power transfer is to allow electrical devices to be continuously charged and lose the constraint of a power cord. There are three main systems used for WPT such as microwaves, resonance, and solar cells. Microwaves would be used to send electromagnetic radiation from a power source to a receiver in an electrical device. The founder of AC electricity, Nikola Tesla, was first to conduct experiments dealing with WPT. His idea came from the notion that earth itself is a conductor that can carry a charge throughout the entire surface. While Tesla's experiments were not creating electricity, but just transferring it, his ideas can be applied to solve our energy crisis. Each application has its respective drawbacks but also has the potential to aid this planet in its dying need for an alternative to creating power.

Today, portable technology is a part of everyday life. But from portability emerges another challenge is energy. Almost all portable devices are battery powered, meaning that eventually, they all must be recharged using the wired chargers currently being used. Now instead of plugging in a cell phone, PDA, digital camera, voice recorder, mp3 player or laptop to recharge it, it could receive its power wirelessly [3]. Although wireless power transfer is feasible and helps in human daily lives, but this technology suffers from several drawbacks namely requires a network of hundreds of satellites and interferences with other electronic devices. There are two techniques in wireless power transfer, which are near-field technique and far-field technique. In general, far-field techniques provide lower frequency transmission with simple pattern measurements and near-field technique with higher frequency transmission and complete pattern measurements.[2]

#### ➤ Near-field Techniques:

The near-field techniques are measuring with appliance near from the power source. It can be broken down into three categories, which are electromagnetic radiation, inductive coupling, and magnetic resonant coupling. These techniques can be used to eliminate problem due to weather and security concerns.

**1. Electromagnetic (EM) Radiation:** Energy from the transmission antenna of a power source to the receiver antenna through radioactive EM waves is the process of emission by EM radiation. Omnidirectional radiation and unidirectional radiation, this two-section classified in the sense of the direction of emitting energy. Through omnidirectional radiation process, broadcasting EM waves via transmitter in an assigned ISM band for example 850–950 MHz or 902–928 MHz in the U.S. which can be varies with the different region both with 915 MHz centre frequency, and a receiver for example RFID tags tunes to the same frequency band to harvest radio power. In omnidirectional radiation though information transfer is easier and more suitable but also suffers from a serious efficiency problem in energy transfer because when the distance is going large there is quick decay of EM waves. By the experiment it was found that when a receiver is 30 cm away from the RF transmitter, power transfer efficiency is only 1.5%.



In addition, to protect potential health hazards of humans from EM radiation, only appropriate process is omnidirectional radiation for ultra-low-power sensor nodes for example up to 10 mW with very low sensing activities like temperature, moisture and light. If there is a clear line-of-sight (LOS) path exists in the process of unidirectional radiation, it can gain high power transmission over a much longer distance for example by using a microwave or laser beam the range can be in kilometre. In the microwave-based system mostly, wireless power is transmitted on microwave frequencies of either 2.45 or 5.8 GHz, both in the ISM frequency band. In the Laser-based system, it is still considered less mature than microwave-based system, transmit power under the visible or near infrared frequency spectrum as an example from several THz to several hundred THz.[2]

**2. Inductive Coupling:** Inductive coupling generally defined as coupling between LC circuits where resonant frequency is same. It works by using magnetic field induction that is the natural part of current's movement through wire, as an example alternating current in a primary coil that is connected to a source can produce a varying magnetic field that induces a voltage across the terminals of a secondary coil at the receiver. Primary and secondary coils are two distinct coils in inductive coupling. Each of these connected wirelessly and the reason of its simplicity, convenience, and safety, inductive coupling has been an important and popular technology to transfer power without wires. With this technological application various kinds of electronic devices have been already made. Therefore, it has been successfully commercialized to a number of products, including electric toothbrush, charging pad for cell phone or laptop, and medical implants. In inductive coupling, power transfer gradually decreases when the two coils are being separate slowly from each other or when the alignment of two coils is not perfect. These kinds of problems are generally occurred when it's not carefully used. It works best when the charging node of the device and power receiving node are close in contact usually less than a coil diameter, for example the range can be in centimetre and the direction of the charging must have to be aligned.

**3. Magnetic Resonant Coupling:** The last and most important category of WPT technology under the section of near field techniques is magnetic resonant coupling. This technology was developed by Kurs et al., which enable to make the interactions between two different objects very strongly because of the combination of inductive coupling and resonance. In addition, energy will be shifting back and forth between magnetic field surrounding the coil and electric field around the capacitor. To the classical mechanical resonance, the effect of magnetic resonance is analogous, under which a string when tuned to a certain tone it can be excited to vibration by a faraway sound generator if there is a match between their resonance frequencies. In this technology, energy can be transferred efficiently from a source coil to a receiver coil with little loss of energy to alternating current in a primary coil (connected to a source) generates a varying magnetic field that induces a voltage across the terminals of a secondary coil at the receiver. An electrical transformer is a good extraneous off-resonant object. There are several advantages of this technology namely highly efficient, radiation loss will be negligible, provides much greater range and directional as compared to inductive coupling. In 1826 Andre-Marie Ampere developed ampere's circuital law showing that electric current produces a magnetic field. Michael Faraday developed Faraday's law of induction in 1831, describing the electromagnetic force induced in a conductor by a time-varying magnetic flux.[2]

#### ➤ Far-field Techniques:

The far-field techniques are measuring the electrical load far from the power source. These techniques aim at high power transfer and need line of sight. It can be separated into two categories, which are microwave power transmission and laser power transmission.

**1. Microwave Power Transmission (MPT):** This technology transfers high power from the base station to the receiving station or mobile devices with two places being in line of sight. With the help of geosynchronous receiving and transmitting satellites, this technology enables the objects to acquire power from the base station with using the magnetron. MPT provides the efficiency in energy conversion but it is slightly difficult to focus the beam in a small region. Besides, this technology could pass through the atmosphere easily. The first step of power transmission is initiated with converting electrical energy to be microwaves energy and then microwaves energy will be captured with using rectenna. In this technology, Alternating Current (AC) cannot be directly converted to microwaves energy. Therefore, AC needs to be converted to Direct Current (DC) first and then DC is converted to microwaves by using magnetron. Transmitted waves are received at rectenna and then rectify microwaves into electricity with more efficiently. It will give DC as the output. In the final step, DC will be converted back to AC. [4][5]

**2. Laser Power Transmission:** This technology is slightly different with MPT where it enables the power concentrated in a small area by utilizing the mirror. This technology also produces high powers that are coherent and not dispersed. However, laser technology gets attenuated when it propagates through atmosphere. In addition, this technology has

been used to apply to a rover to explore the presence of ice in the bottom of craters of the moon where no sunlight is available. On the other hand, the solar energy generated by the radiation is converted into the electric energy. This energy next will be converted to the laser light and then transmitted to the rover working at the bottom of the crate.

• **H-bridge circuit:**

An **H-bridge** is an electronic circuit that switches the polarity of a voltage applied to a load. These circuits are often used in robotics and other applications to allow DC motors to run forwards or backwards.

Most DC-to-AC converters (power inverters), most A/C-A/C converters, the DC-to-DC converters, push-pull converters, isolated DC-to-DC converters, most motor controllers and many other kinds of power electronics use H bridges. In particular, a bipolar stepper motor is almost always driven by a motor controller containing two H bridges.[8]

• **Cascade H-bridge:**

Demand for energy is getting increased day by day. The key source of energy available now is from non-renewable sources like fossil fuels. The over utilization of these sources to meet our daily requirements have put it in a degradation state. Hence, there is a rapid development in the research to produce energy from alternate sources, such as wind, solar, tidal, etc. Among them, energy taken from photovoltaic systems plays an important role. The energy which is taken from a photovoltaic system (PV system) is DC in nature. Most of the equipment are used for domestic and industrial purposes which work on an AC source, the DC output from a PV system is converted into an AC and for this purpose, power inverters play a major role. The concept of multilevel inverter is based on connecting H-bridge inverters in series to get a sinusoidal voltage output. Figure 3 shows a full-bridge inverter. One full-bridge is itself a three-level cascaded H-bridge multilevel inverter and every module added in cascade which extends the inverter with two voltage levels. Each full-bridge inverter can create three voltages  $V_{DC}$ , 0 and  $-V_{DC}$ . To change one level of voltage cascaded H-bridge multilevel inverter turns one switch ON and other switch OFF in one full-bridge inverter. For example, to achieve voltage  $+V_{dc}$ , switches  $S_1$  and  $S_2$  are turned ON, for  $-V_{dc}$ , the switches  $S_3$  and  $S_4$  are turned OFF. When there is no current following through the full-bridge, then 0 voltage level is achieved.

The output voltage in each bridge is the summation of the voltage that is generated by each cell. The number of output voltage levels are  $2n + 1$ , where  $n$  is the number of cells. The cascaded H-bridge multilevel inverter is capable of producing the total voltage source magnitude in both positive and negative half cycles, while many other topologies can only produce half the total DC-bus voltage source magnitude. Full-bridge inverter that is connected in series can contribute with the same voltage, thus meets topology. There is possibility to charge every module in a cascaded H-bridge multilevel inverter with different voltages.[9]

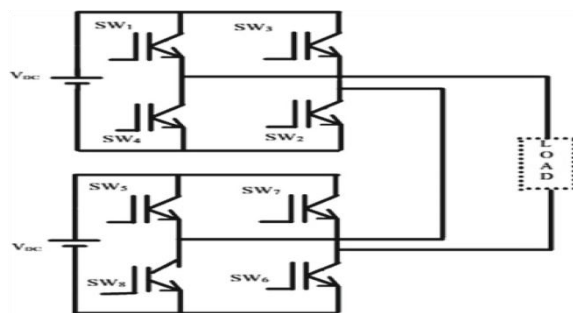


Figure 3: cascaded H-bridge circuit

❖ **Modelling of wireless power transmission (WPT):**

In the modelling of wpt circuit we are using the three different combinations of input and output i.e., AC-DC, DC-DC and AC-DC. The load given was also of different types i.e., the combination of RL, RLC, RC, L, C. Practically the loads of only inductor and capacitor are not possible but for the experimental purpose we referred the solely inductor and capacitor.

**1.AC input model of WPT:**

This model consists of simple circuit of a near field representation of magnetically coupled inductor. This circuit represents the model in the figure 2 of our paper. The modelling is tallied again with different types of loads.

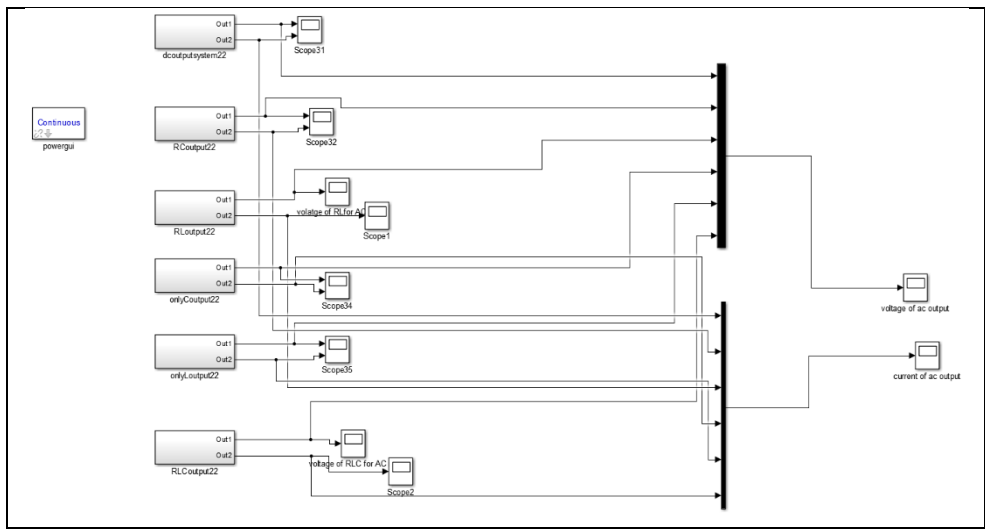


Figure 4: system with different combinations of output and AC input

This is a system of wireless power transmission with the single-phase AC input. The different subsystems contain the different types of loads as mentioned (RL, RLC, RC, L, C). The comparison of output will be mentioned in the further explanation of the paper.[10][11]

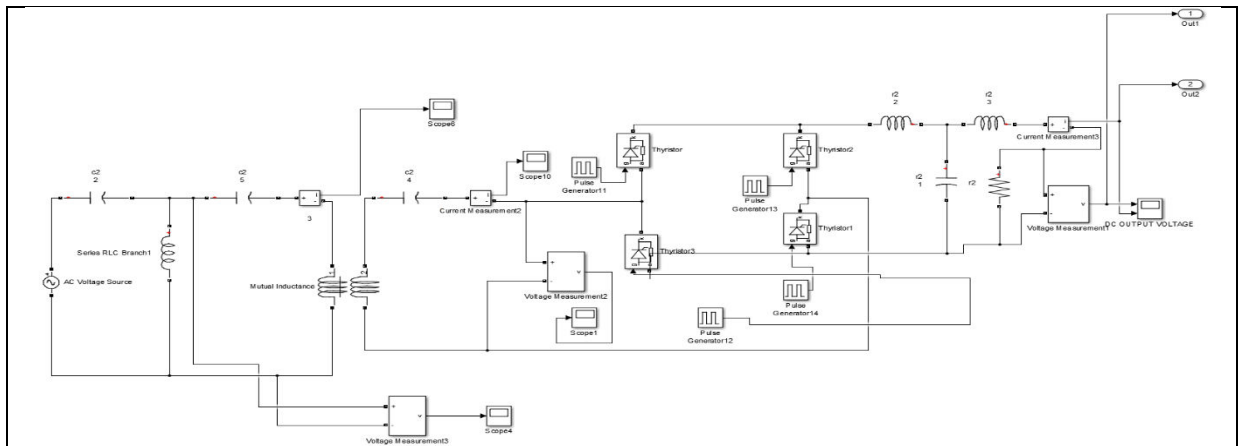


Figure 5: AC input with DC output

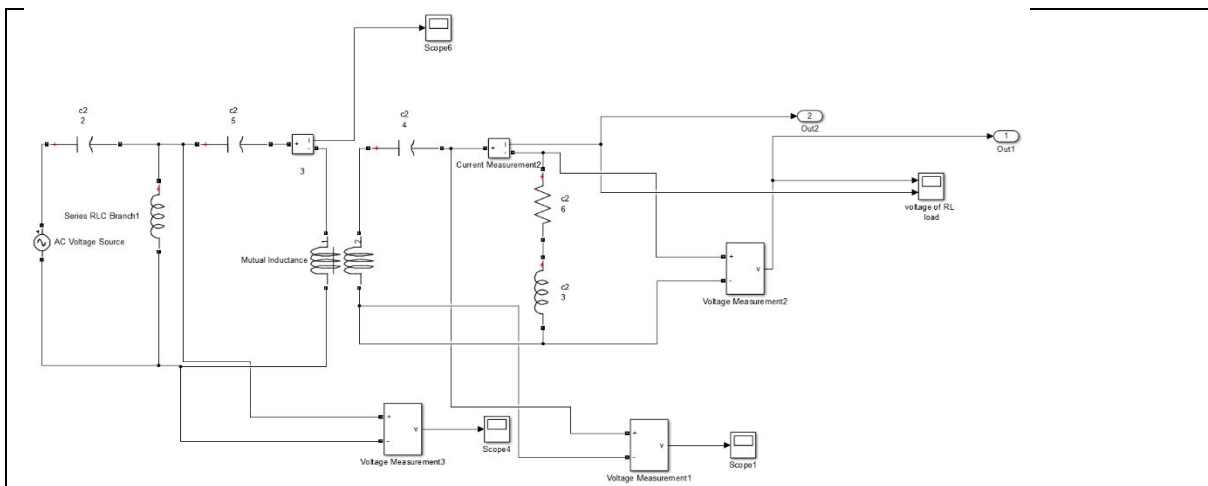
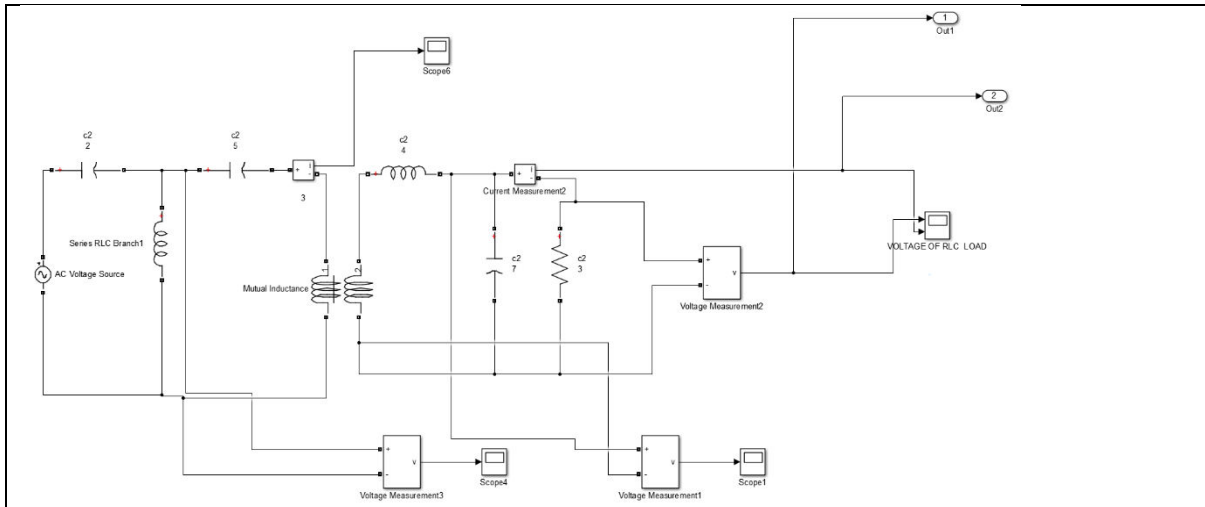


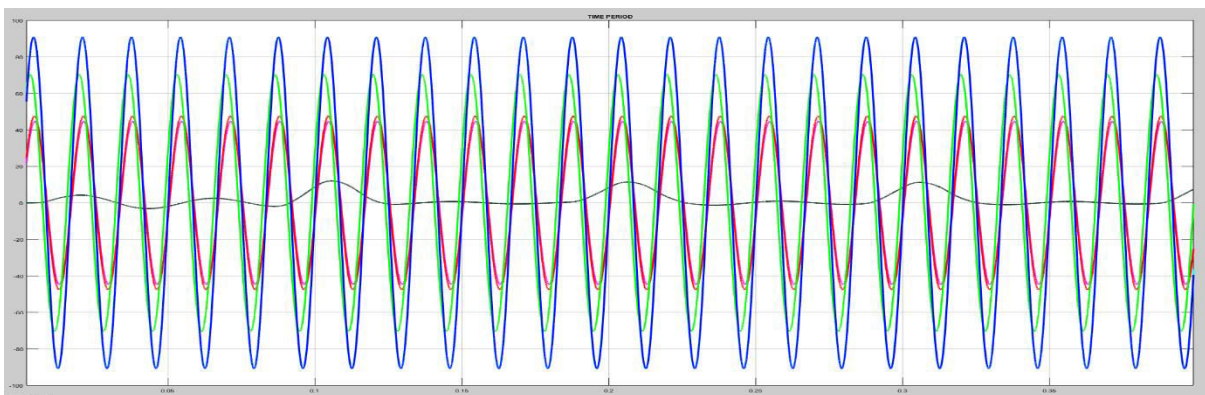
Figure 6: AC input with RL load



**Figure 7:** AC input with RLC output

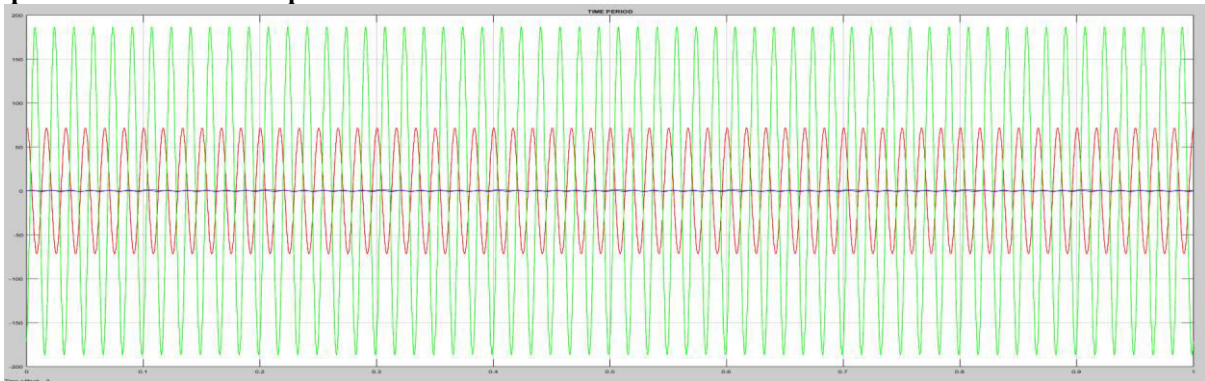
The outputs of the above circuits will be given as the following figures that will be shown. According to that we can calculate the different types of characteristics of the load. Some of them will be mentioned in our paper efficiency and total harmonic distortion. As per that values we can select the system which was more reliant and sophisticated.

**Output voltage of the AC input WPT circuit with different load combinations:**



**Figure 8:** Output voltage of the AC input WPT circuit with different load combinations

**Output current of the AC input WPT circuit with different load combinations:**

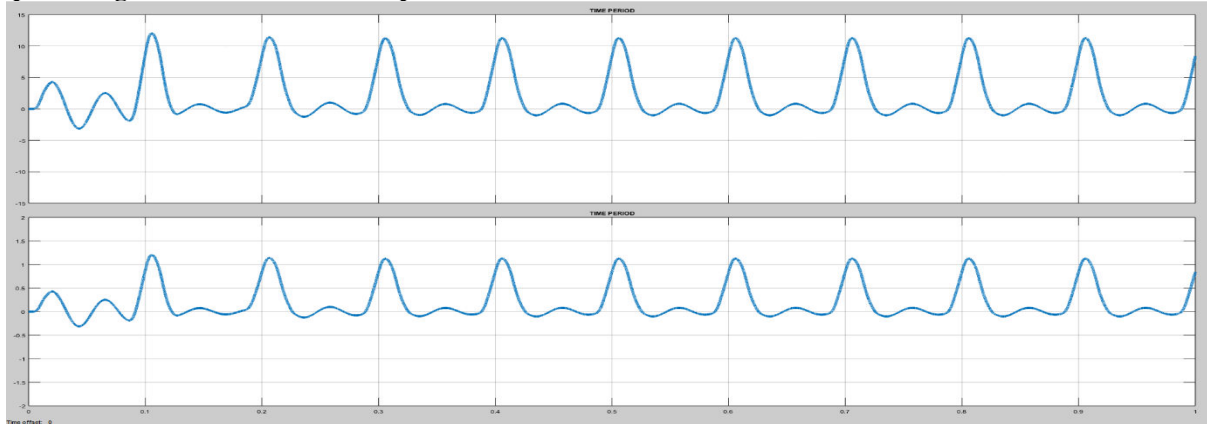


**Figure 9:** Output current of the AC input WPT circuit with different load combinations



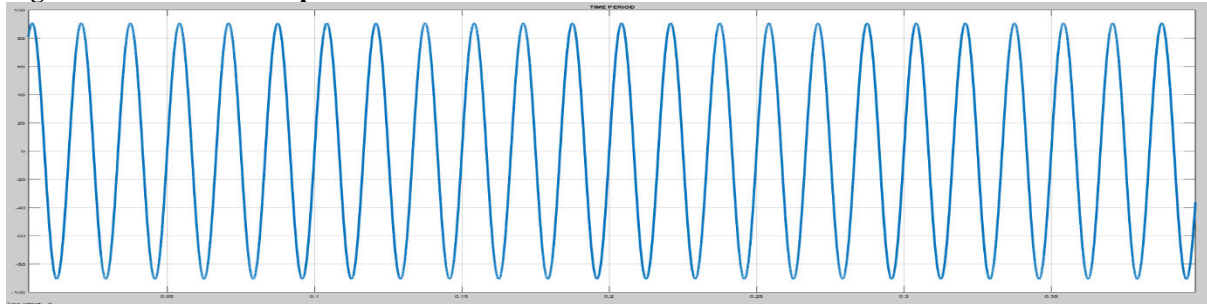


**Output voltage and current of DC output:**



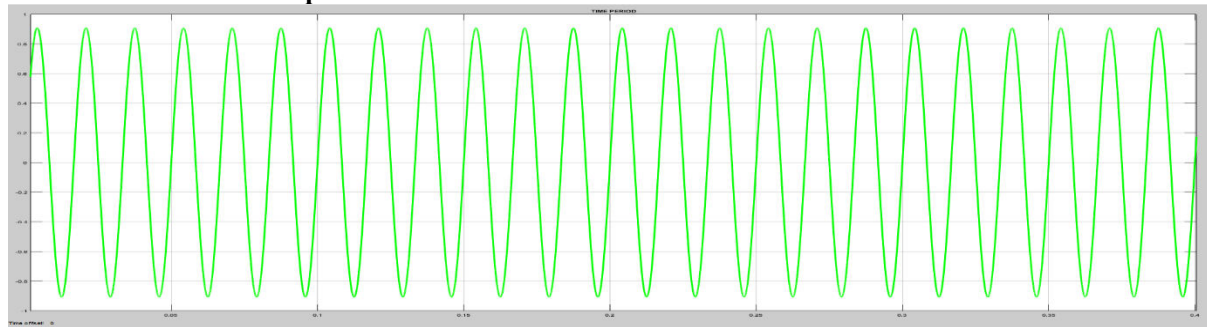
**Figure10:** Output voltage and current of DC output:

**Voltage of RL load for AC input:**



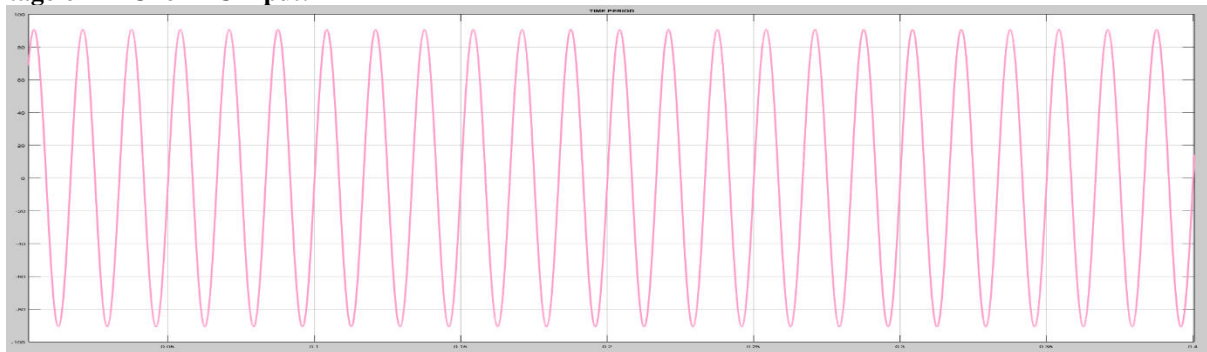
**Figure 11:** Voltage of RL load for AC input

**Current of RL load for AC input:**



**Figure 12:** Current of RL load for AC input

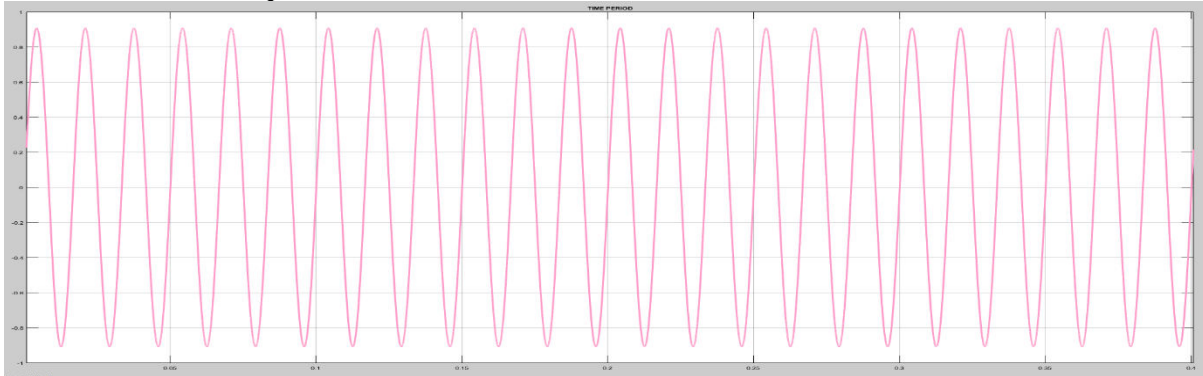
**Voltage of RLC for AC input:**



**Figure 13:** Voltage of RLC for AC input



**Current of RLC for AC input:**

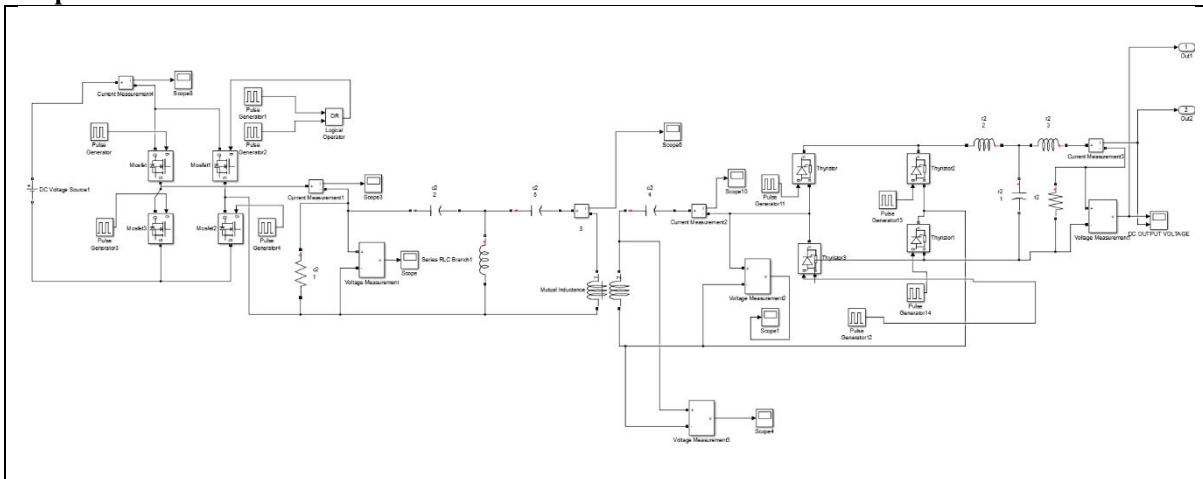


**Figure 14:** Current of RLC for AC input

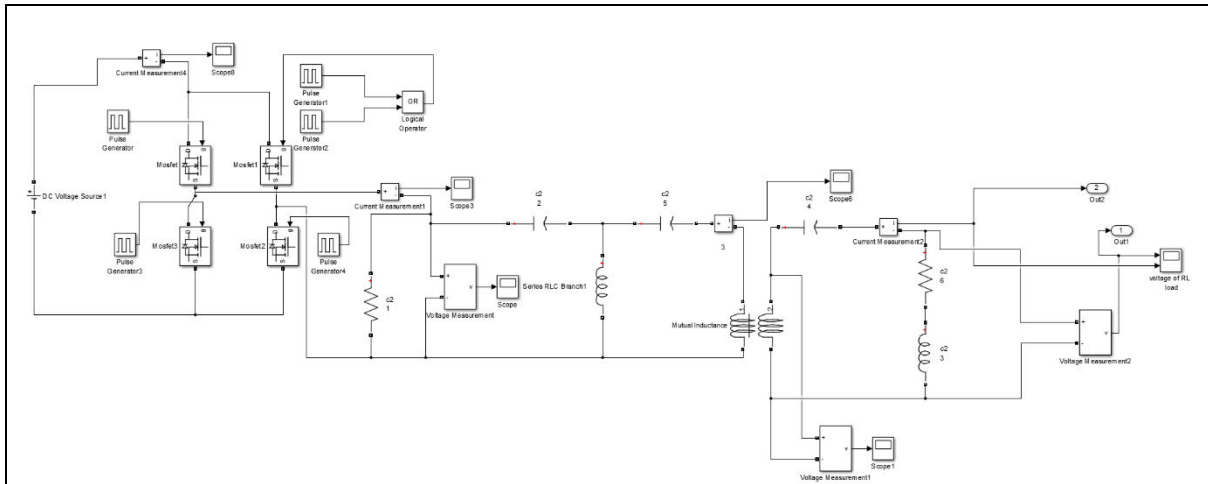
Type of load	Voltage (in volts)	Current (in ampere)
Dc load	12	1.2
RL	90.5	0.91
RC	45	0.45
RLC	91	0.9
INDUCTIVE	70	190
CAPACITIVE	47.5	72

**Table 1:** values of voltage and current of AC input WPT model

**2.DC input MODEL OF WPT:**



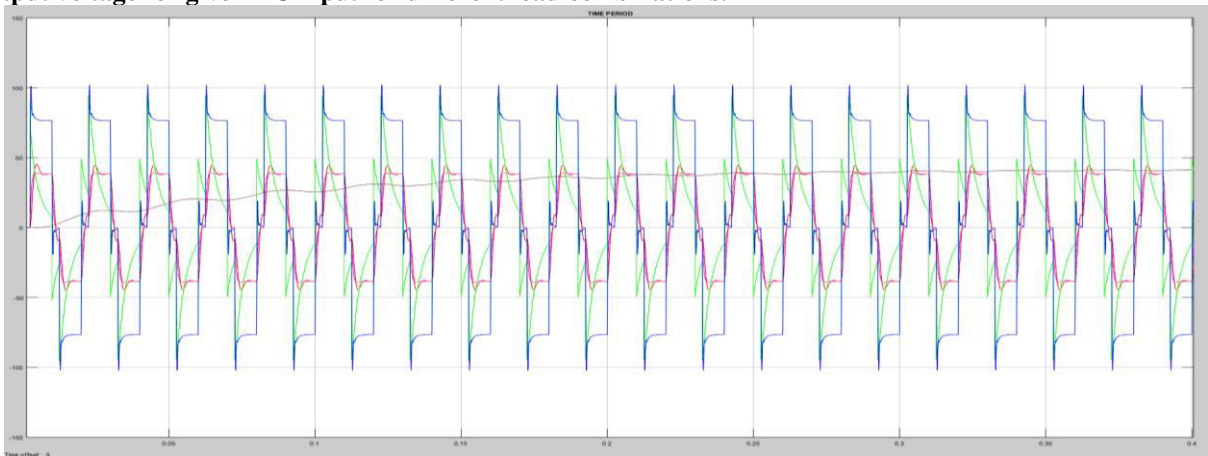
**Figure 15:** H bridge input to the WPT model with DC output



**Figure 16:** H bridge DC input model of WPT with RL load

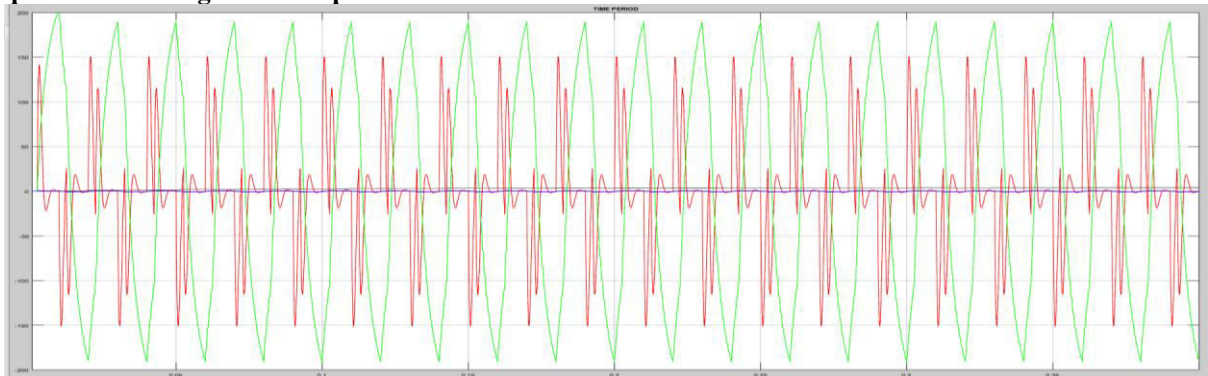
Similarly for the output combinations of different loads, we can also connect different loads to the output leg in the place of RL combination in the figure 15 and thus we obtain different values of voltage and currents where we can get the efficiency and thd of the obtained output.

**Output voltage for given DC input for different load combinations:**



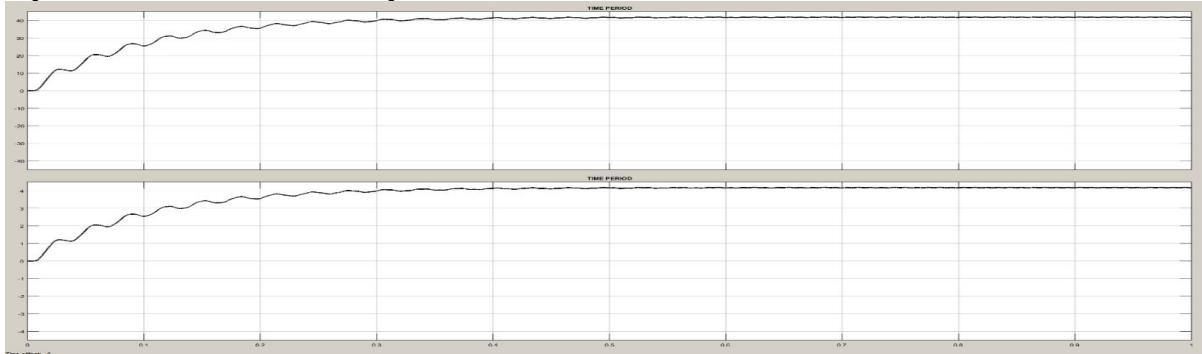
**Figure 17:** Output voltage for given DC input for different load combinations

**Output Current for given DC input for different load combinations:**



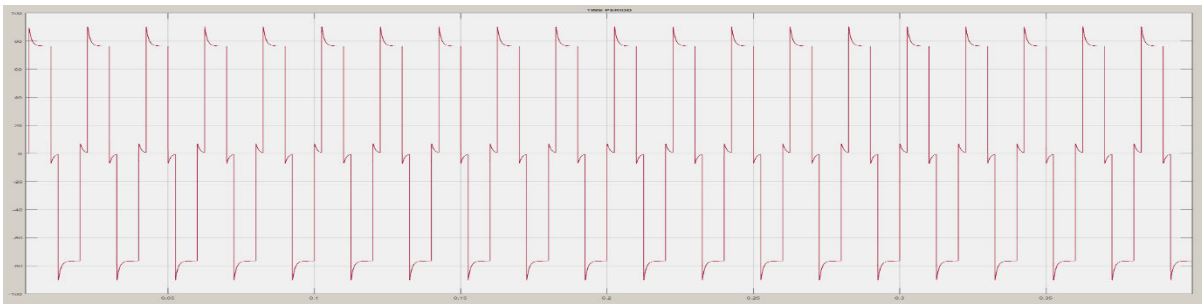
**Figure 18:** Output Current for given DC input for different load combinations

**DC input model of WPT with DC output:**



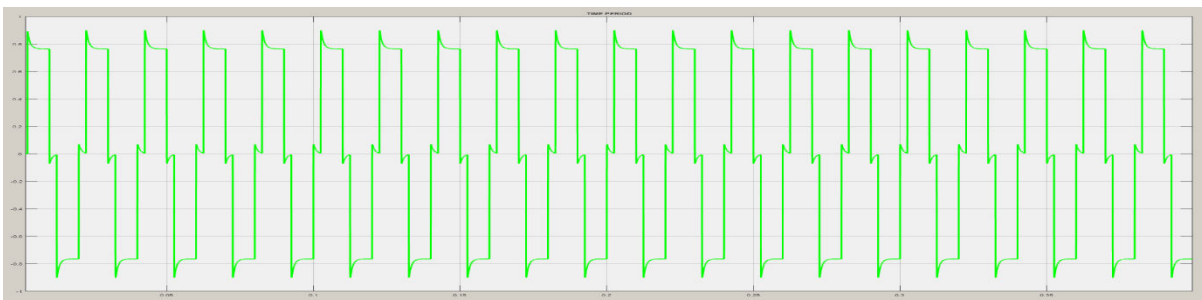
**Figure 19:**DC input model of WPT with DC output

**Output voltage of DC input of WPT with RL load:**



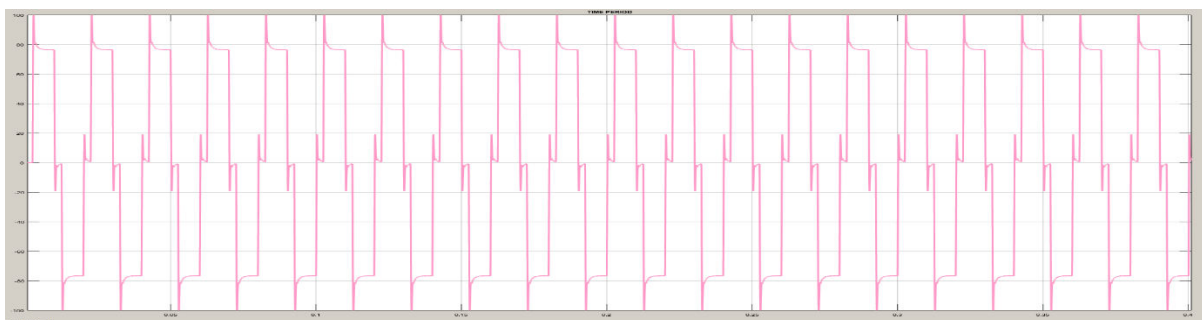
**Figure 20:**Output voltage of DC input of WPT with RL load

**Output current of DC input of WPT with RL load:**



**Figure 21:**Output current of DC input of WPT with RL load

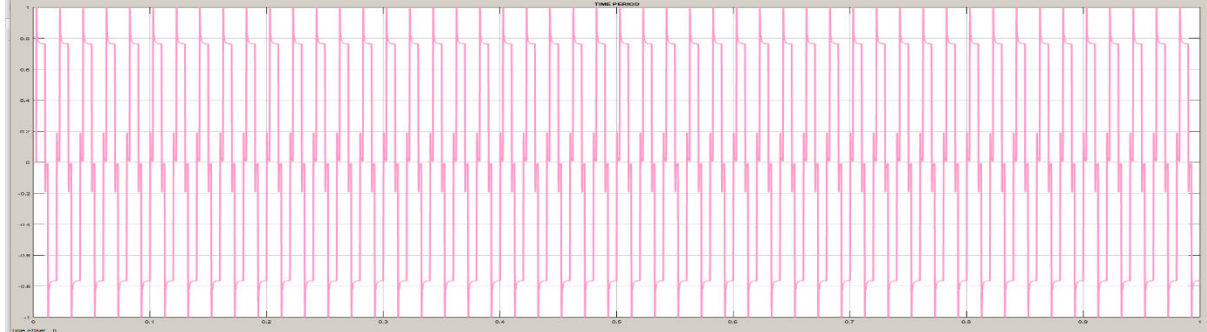
**Output voltage of DC input of WPT with RLC load:**



**Figure 22:**Output voltage of DC input of WPT with RLC load



**Output current of DC input of WPT with RLC load:**



**Figure 23:** Output current of DC input of WPT with RLC load

Type of load (input=100v)	Voltage (in volts)	Current (in ampere)
Dc load	42	4.5
RL	90	0.9
RC	39	0.4
RLC	45	1
INDUCTIVE	94	190
CAPACITIVE	102	150

**Table 2:** voltage and current values of H-bridge input model of WPT

**3.Design of WPT with the input using cascaded H bridge:**

The output of this H-bridge circuit was given to the inductor circuit which undergoes the power transmission wirelessly.

➤ **Switching sequences of MOSFET:**

	0	v	2v	v	0	-v	-2v	-v
S1	1	1	1	1	1	0	0	0
S2	1	0	0	0	1	1	1	1
S3	0	0	0	0	0	1	1	1
S4	0	1	1	1	0	0	0	0
S5	1	1	1	1	1	1	0	1
S6	1	1	0	1	1	1	1	1
S7	0	0	0	0	0	0	1	0
S8	0	0	1	0	0	0	0	0

**Table3:** switching sequences of the MOSFET used in the H-bridge and the cascaded H-bridge circuit.

	DELA Y	PULS E WIDT H	OR opera tion	DEL AY	PULSE WIDT H
S1	$\frac{0.02}{8} * 0$	$\frac{5}{8} * 100$	NO	NA	NA
S2	$\frac{0.02}{8} * 0$	$\frac{1}{8} * 100$	YES	$\frac{0.02}{8} * 4$	$\frac{4}{8} * 100$
S3	$\frac{0.02}{8} * 5$	$\frac{3}{8} * 100$	NO	NA	NA
S4	$\frac{0.02}{8} * 1$	$\frac{3}{8} * 100$	NO	NA	NA
S5	$\frac{0.02}{8} * 0$	$\frac{6}{8} * 100$	YES	$\frac{0.02}{8} * 7$	$\frac{1}{8} * 100$
S6	$\frac{0.02}{8} * 0$	$\frac{2}{8} * 100$	YES	$\frac{0.02}{8} * 3$	$\frac{5}{8} * 100$
S7	$\frac{0.02}{8} * 6$	$\frac{2}{8} * 100$	NO	NA	NA
s8	$\frac{0.02}{8} * 2$	$\frac{1}{8} * 100$	NO	NA	NA

▪ Cascaded H-bridge input WPT modelling:

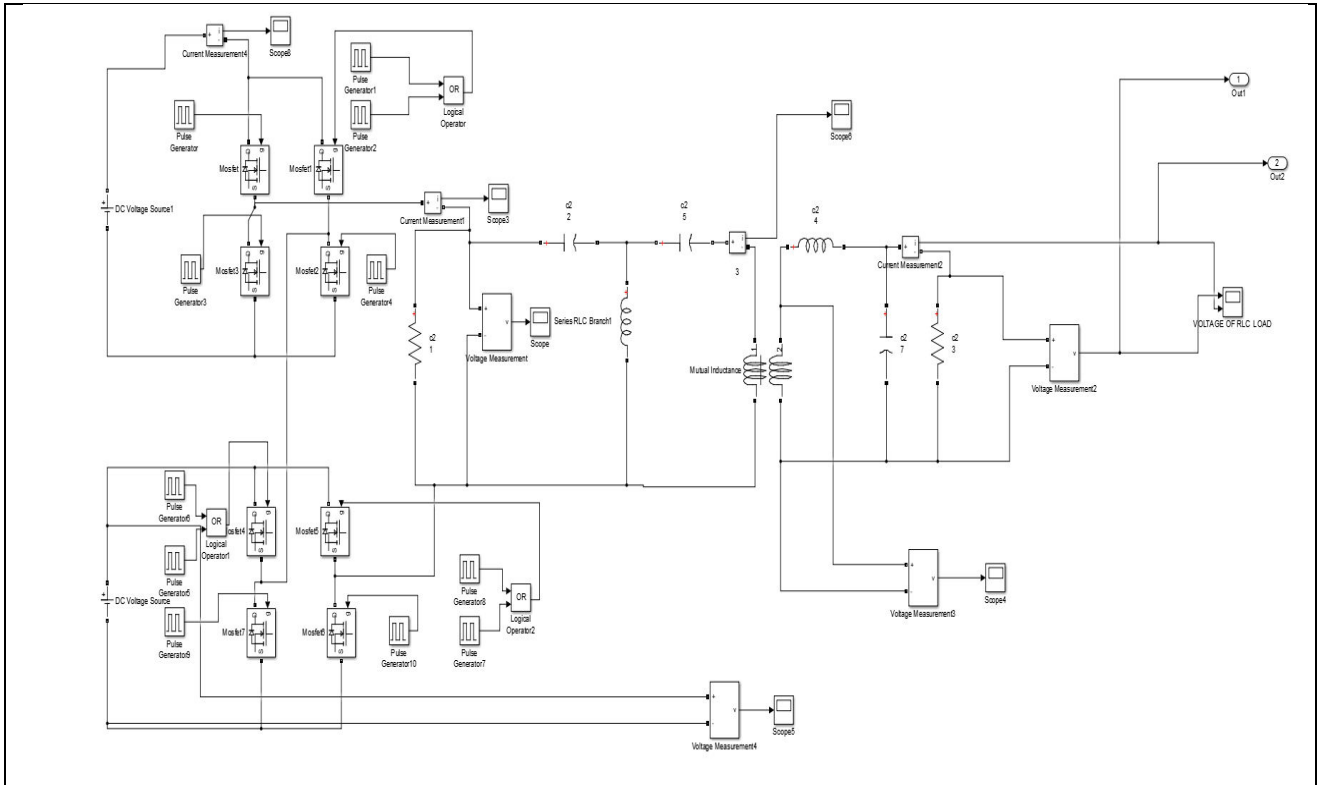


Figure 24: Cascaded H-bridge input WPT modelling

Voltage output of cascaded H-bridge:

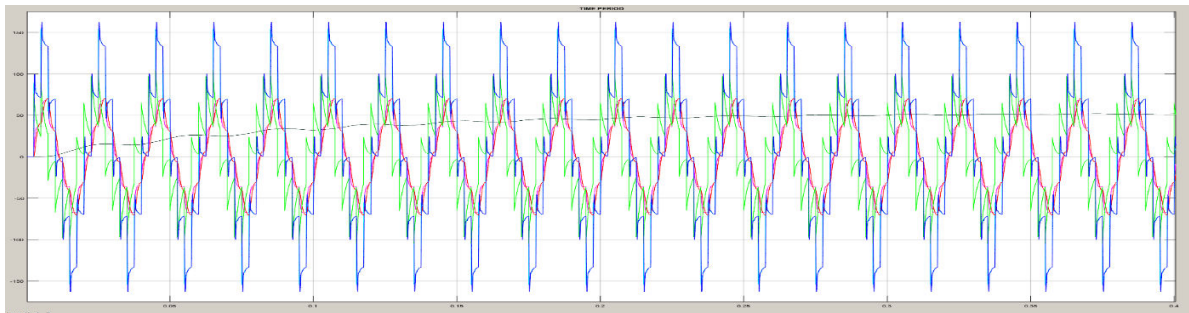


Figure 25: Voltage output of cascaded H-bridge

Current output of cascaded H-bridge:

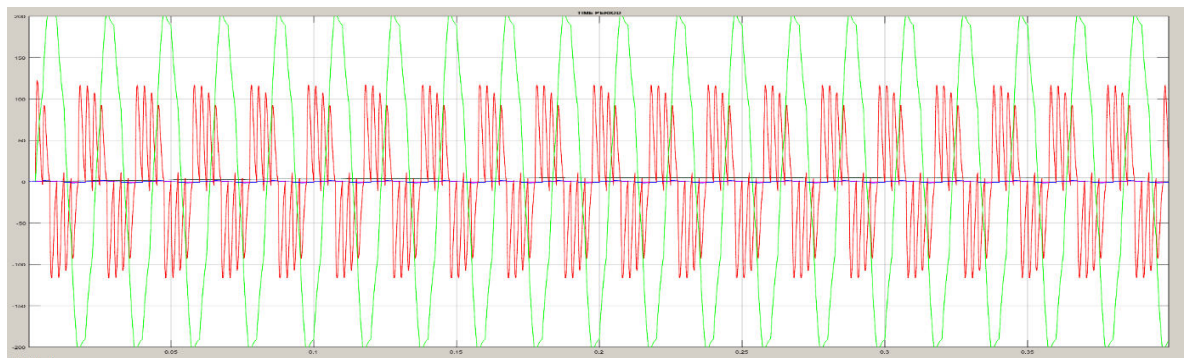


Figure 26: Voltage output of cascaded H-bridge



Type of load (input=200v)	Voltage (in volts)	Current (in ampere)
Dc load	53	5
RL	155	1.5
RC	68	0.7
RLC	155	1.6
INDUCTIVE	100	210
CAPACITIVE	70	110

**Table 4:** voltage and current of cascaded H-bridge model of WPT

➤ **Comparison between the output efficiencies of different types of loads:**

TYPE OF LOAD	H-bridge input(200v)		DC input(100v)		AC input(100v)	
	efficiency	THD	efficiency	THD	efficiency	THD
DC output(R=100Ω)	28%	65.99%	44%	66.54%	12%	53.35%
RL (R=100 Ω, L=1mH)	75%	31.66%	90%	31.37%	90%	36.51%
RC (R=100 Ω, C=10μF)	35%	22.23%	39%	23.22%	45%	40.74%
RLC (R=100 Ω, L=10mH, C=1μF)	80%	31.58%	98%	31.17%	90%	37.43%
INDUCTIVE(L=1mH)	50%	57.67%	90%	49.05%	70%	26.31%
CAPACITIVE(C=4000μF)	35%	21.72%	45%	24.08%	48%	39.99%

**Table 5:** Comparison between the output efficiencies of different types of loads

**Advantages and disadvantage:**

Wireless power transfer will be next biggest move in these integrated technologies world because it has numerous advantages and applications.

**Advantages:**

we don't have need to stick with wires while using any electric device like mobile, laptop, camera etc. complete removal of wires is possible by WPT so system becomes very user friendly and complexity can be reduced. At public places like Malls and stations, complexity of power system can be reduced by WPT.

**Disadvantages:**

Major disadvantage of wireless power transfer is high power loss for longer distance. So, we can transfer power wirelessly from one point to another very efficiently if distance is too small but loss rapidly increases with distance.

**IV. FUTURE SCOPE**

Wireless power transmission is building a near field wireless charging apparatus for consumer devices with the help of the Haier group, a Chinese electronics manufacturer. WPT demonstrated this technology by wireless powering a 32-inch television at a distance of six feet. Delphi Automotive is working with WPT to develop a wireless charging system for electric cars. The ground-breaking technology will enable to automotive manufacturer to integrate wireless charging into the design of hybrid & electric vehicles. There is another standard protocol for charging mobile phone initiated by the Wireless Power Consortium.

**V. CONCLUSION**

The concept of wireless power transmission offers greater possibilities for transmitting power with negligible losses. In the long run, this could reduce our society's dependence on batteries, which are currently heavy and expensive. As wireless technology is getting popular now a days, the demand of battery is also decreasing. For the long-range power



transmission power can be sent from source to receivers instantaneously without wires, reducing the cost. Batteries need to be recharge or changed eventually, hence the need for this kind of work.

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