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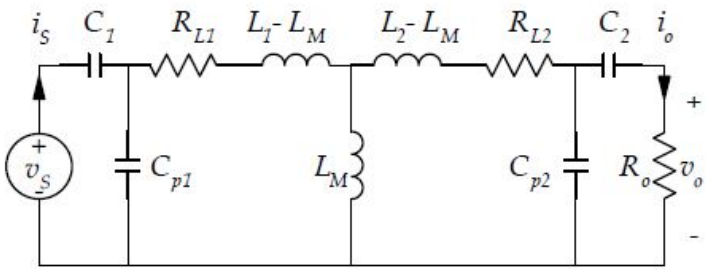
SigSys Project Proposal: Wireless Power Transfer

Near-field wireless power transfer is achieved by creating a voltage across one inductor, and using the resulting magnetic field to induce a voltage in the receiving circuit. There are two types of wireless power transfer (WPT) systems: inductive WPT and electrodynamic WPT. An electrodynamic WPT system is comprised of a transmitting coil and electromechanical receiver. The electromechanical receiver is composed of a permanent magnet, on which a force and/or torque is induced by the transmitter coil. The force and/or torque induced relates to the distance between the transmitter and receiver. The mechanical energy produced by the permanent magnet is converted into electrical energy using an electromechanical transducer. An inductive WPT system is different from an electrodynamic WPT system, because the inductive WPT system simply induces a current in the receiver. Since inductive WPT systems tend to be more efficient than electrodynamic WPT systems, we are planning on exploring and building our own inductive WPT system.



A circuit diagram of our system[1]

Initially, we would develop a simple circuit that can power a light at a short distance. We plan to use a pair of closely matched copper wire coils (courtesy of Oscar) to transmit and receive power. Using this system, we would verify existing models of distance-power relationships and efficiencies. Our system will be treated as an LTI system, a characteristic which we will use to determine its transfer function and optimal frequency and resistance.

After we have achieved a working system, we may build a cell phone charger, if time permits. Our reach goal for this project is to investigate how to maximize efficiency of the cell phone charger through changing various factors (eg. type of coil, winding of coil, size of coil, RLC values, etc.). We would like to investigate the effect of distance, objects between the inductors, and RC values on the amount of voltage transmitted. For objects between the

[1] Mur-Miranda, Jose Oscar, Giulia Fanti, Yifei Feng, Keerthik Omanakuttan, Roydan Ongie, Albert Setjoadi, and Natalie Sharpe. *Wireless Power Transfer Using Weakly Coupled Magnetostatic Resonators*. Franklin W. Olin College of Engineering, n.d. Web.

inductors, it would be interesting to investigate the difference between electromagnetically resonant objects and non-electromagnetically resonant objects. Additionally, we are interested in the effects of multiple receiving circuits. Theoretically, if none of them overlap in space with each other then there should be no interference, but is this truly the case.

Documentation for this project will involve a blog post and a video of our working setup. Our blog post will explain the process of building the system, show a demonstration of our system and illustrate and analyze the results of our project. We will hopefully have additional information on optimizing the system to present as well. The video of the working system is for the eventuality that the system is temperamental on presentation day. If the system is reliable, we will do a live demonstration hopefully including sending power through a wall or table.