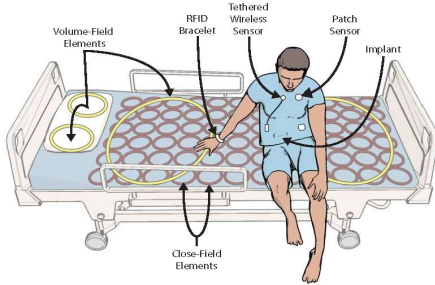


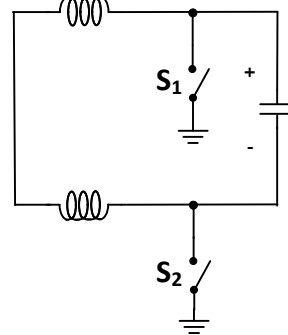
Motivation

- Internet of Things (IoT) has unlocked a world of massively interconnected devices
- Single frequency wireless power transfer (WPT) techniques lack scalability
- Direct-Sequence Spread-Spectrum WPT (DSSS-WPT) offers scalable and secure methods for WPT



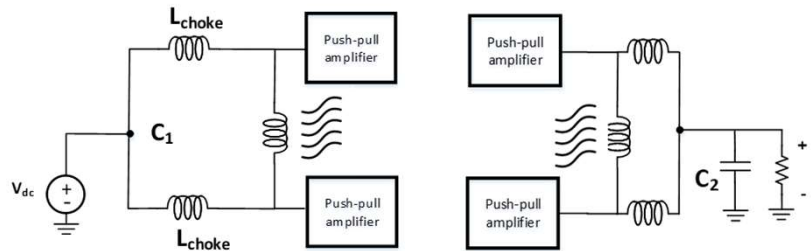
Power Amplifier and Rectifier

Push-pull amplifier- Building block



- Can arbitrarily hold the inductor state
- Allows for soft-switching helping achieve higher efficiency

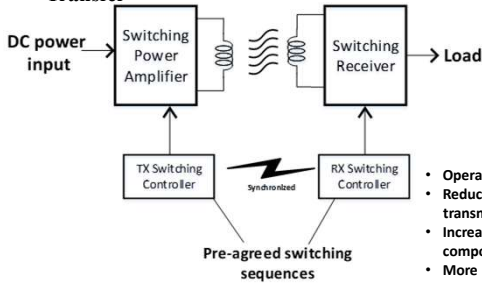
Transmitter and Receiver



- Four quadrant push-pull amplifiers and rectifier
- For high quality factor allow for arbitrary placement of positive and negative half sine waves with variable zero durations

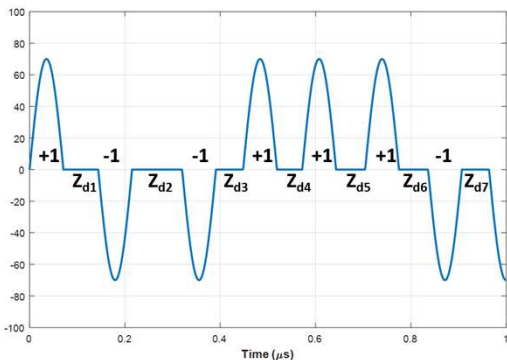
CDMA for Wireless Power Transfer

1. Direct-Sequence Spread-Spectrum Wireless Power Transfer



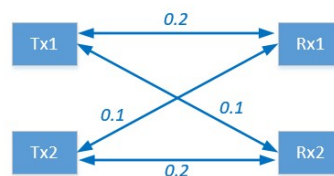
- Operation outside ISM bands possible
- Reduced interaction between coupled transmitters and receivers
- Increased tolerances for passive components
- More secure
- Lower EMI

2. Digital Abstraction



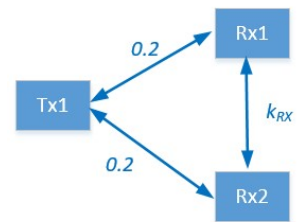
- Half sine waves with variable zero duration
- Abstraction to (P, Z_d)
- Understanding the power transfer through relationship between transmitter and receiver codes
- Orthogonal codes for minimizing unintended interactions

Results and Discussion

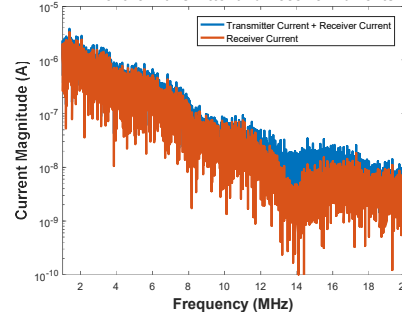


- $P_{Tx1} = 15 \text{ W}$ $P_{Rx1} = 12.7 \text{ W}$
- $P_{Tx2} = 17.3 \text{ W}$ $P_{Rx2} = 17.3 \text{ W}$

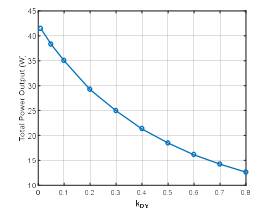
- Very little cross talk between the 2 WPT systems



FFT of the Transmitter and Receiver Currents



- Spectrum of transmitter and Receiver current



- Effect of receiver cross coupling for single transmitter and multiple receiver

Conclusion

The growth of IoT has increased the demands for scalable techniques for wireless power transfer. DSSS-WPT allows for implementing code division multiplexing for WPT in addition to other popular techniques of using compensation, impedance matching, time division multiplexing and frequency division multiplexing. Simulations with multiple receivers and multiple transmitters are presented demonstrating the effectiveness of DSSS-WPT as a candidate for multiple access WPT