Design of High Gravimetric Power Density Wireless Charging Transmitter For Drones

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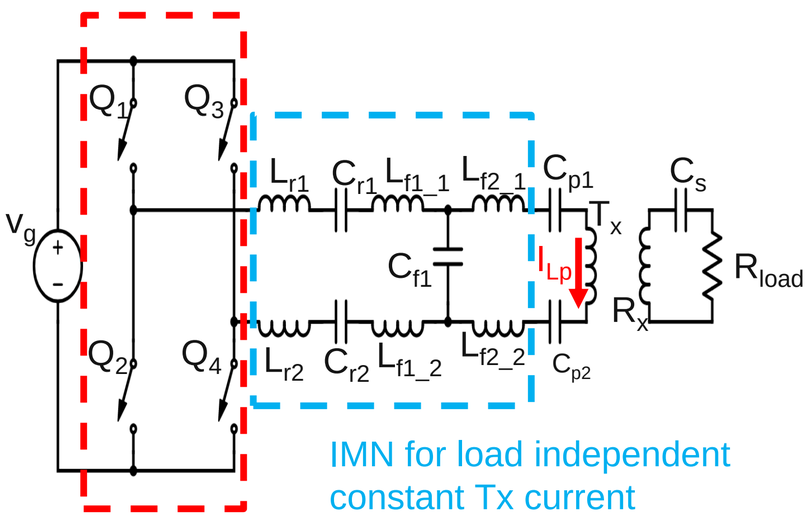
MOTIVATION FOR HIGH GRAVIMETRIC POWER DENSITY WPT SYSTEM

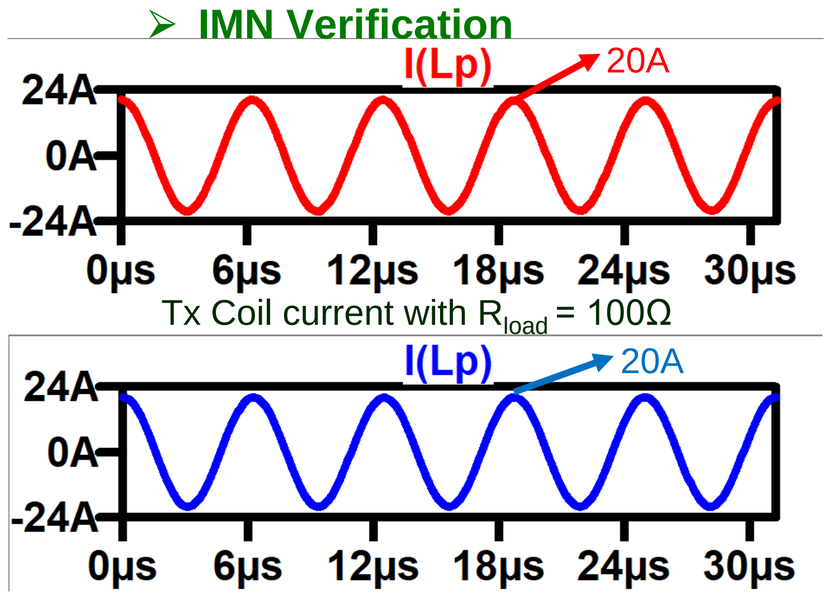
- Flight Time: Maximize the time the drone can be in operation and not charging
- Light weight: Make the on board WPT receiver have high gravimetric power density to charge fast but be lightweight so the drone can achieve maximum flight time
- Fast charging: Charge the drone fast to minimize the time charging and out of operations

SYSTEMATIC DESIGN METHOD

Equivalent circuit for WPT transmitter



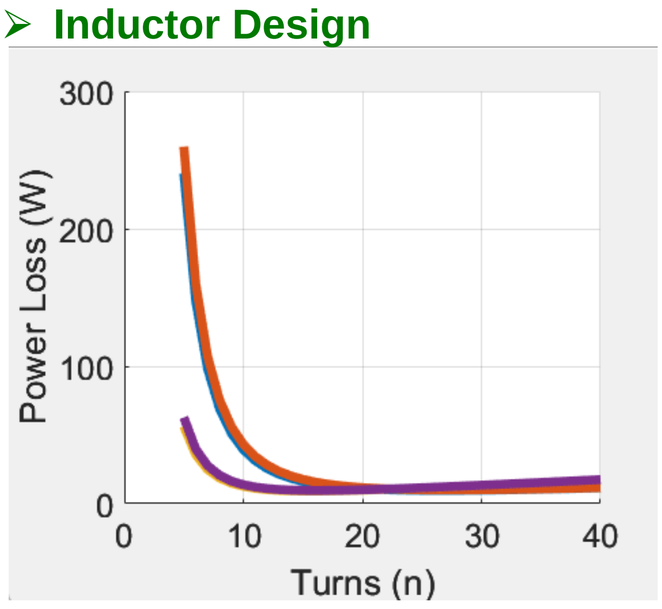
IMN Verification



Tx Coil current with R_{load} = 100Ω

Tx Coil current with R_{load} = 10Ω

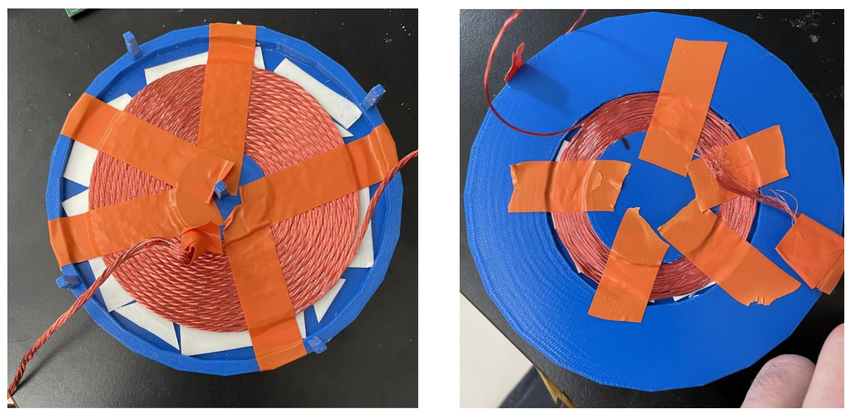
Inductor Design



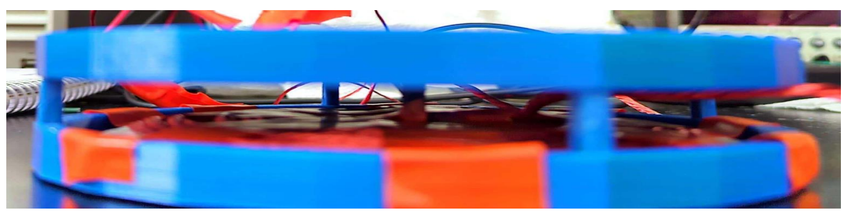
Optimal inductor design using multiple different core sizes and materials

PROTOTYPE VERIFICATION

Coil formers for T_x & R_x coils

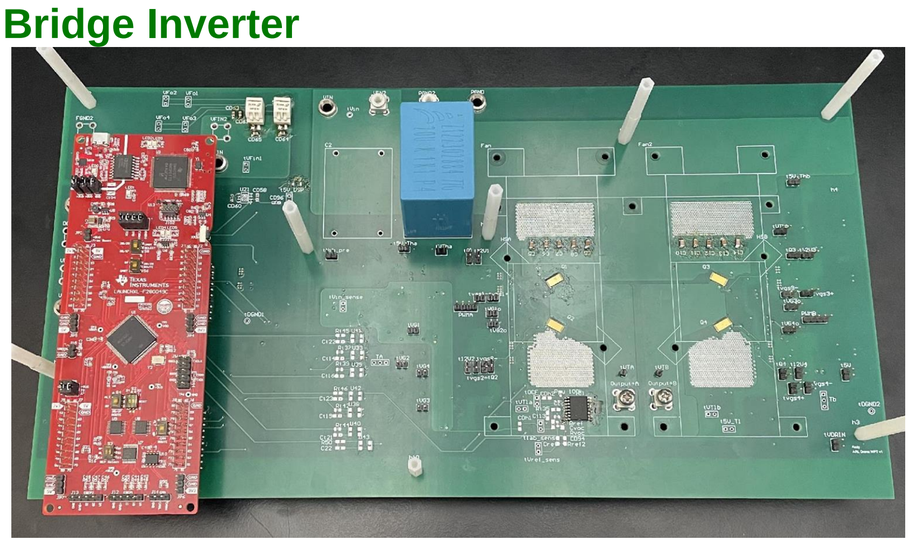


Tx and Rx 3D printed coil formers with constructed coils

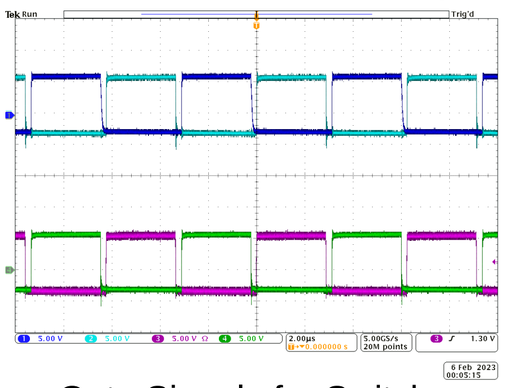


3D printed coil formers for WPT mounted together

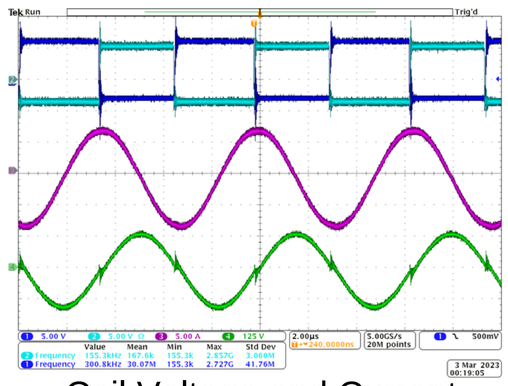
Full Bridge Inverter



Full Bridge Inverter PCB assembled



Gate Signals for Switches



Coil Voltage and Current

CONCLUSIONS

- Completed theoretical design stage, achieving a functional WPT transmitter
- Designed coil formers and constructed Tx/Rx coils for WPT
- Completed assembly and testing for full bridge inverter

FUTURE WORK

- Implement sensing circuitry and controls to ensure safe operations conditions
- Test Hardware with WPT receiver board designed by colleague Arka Basu
- Finish IMN assembly