

Starwars - Wireless Power Charger

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Context

Robotics systems are constantly evolving and occupy a place increasingly important in our society. A lot of autonomous robotic applications within the medium power range (around 400W) are actually available and are constantly evolving. This growing market is currently in need of a wireless power charging solution within the medium power range given its many benefits. It allows the robot to be completely autonomous, including the charging process. It allows also to avoid all disadvantages of charging by contact. There are different examples of robots like :

- The golf ball pickup robot by Belrobotics

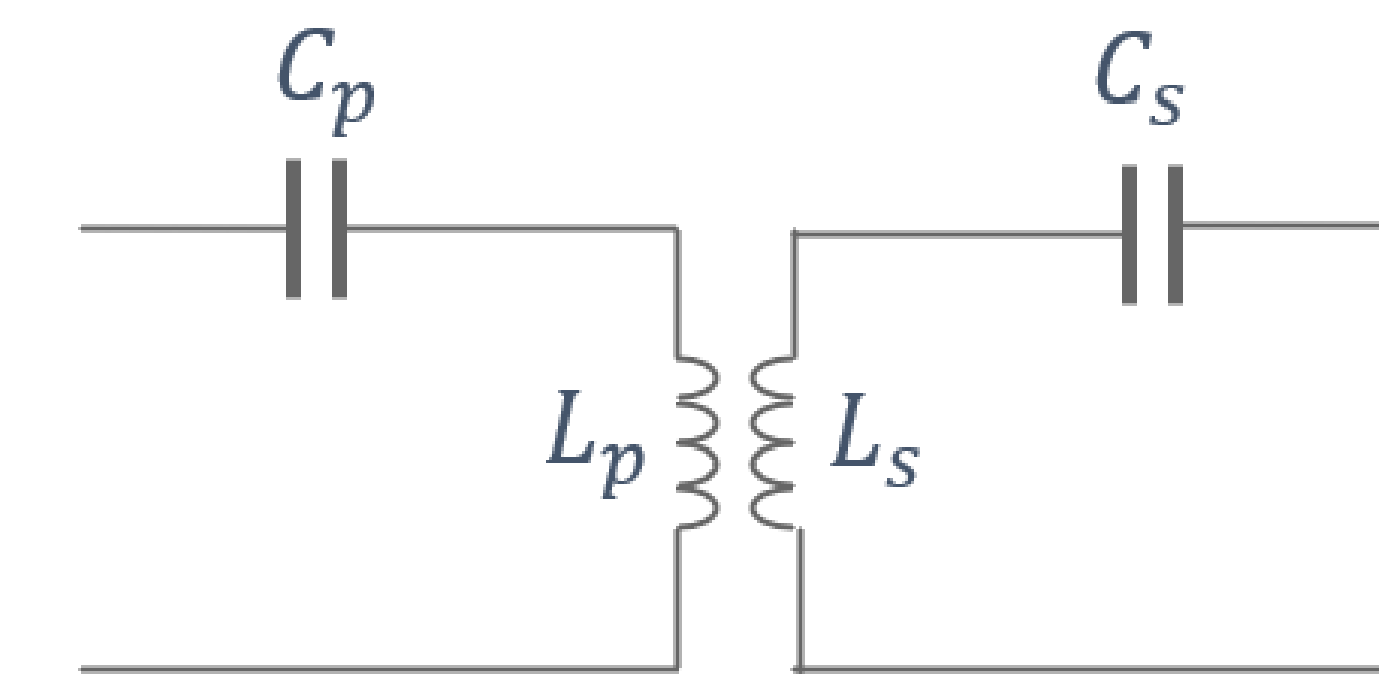


- The AGV robot by Quimesis



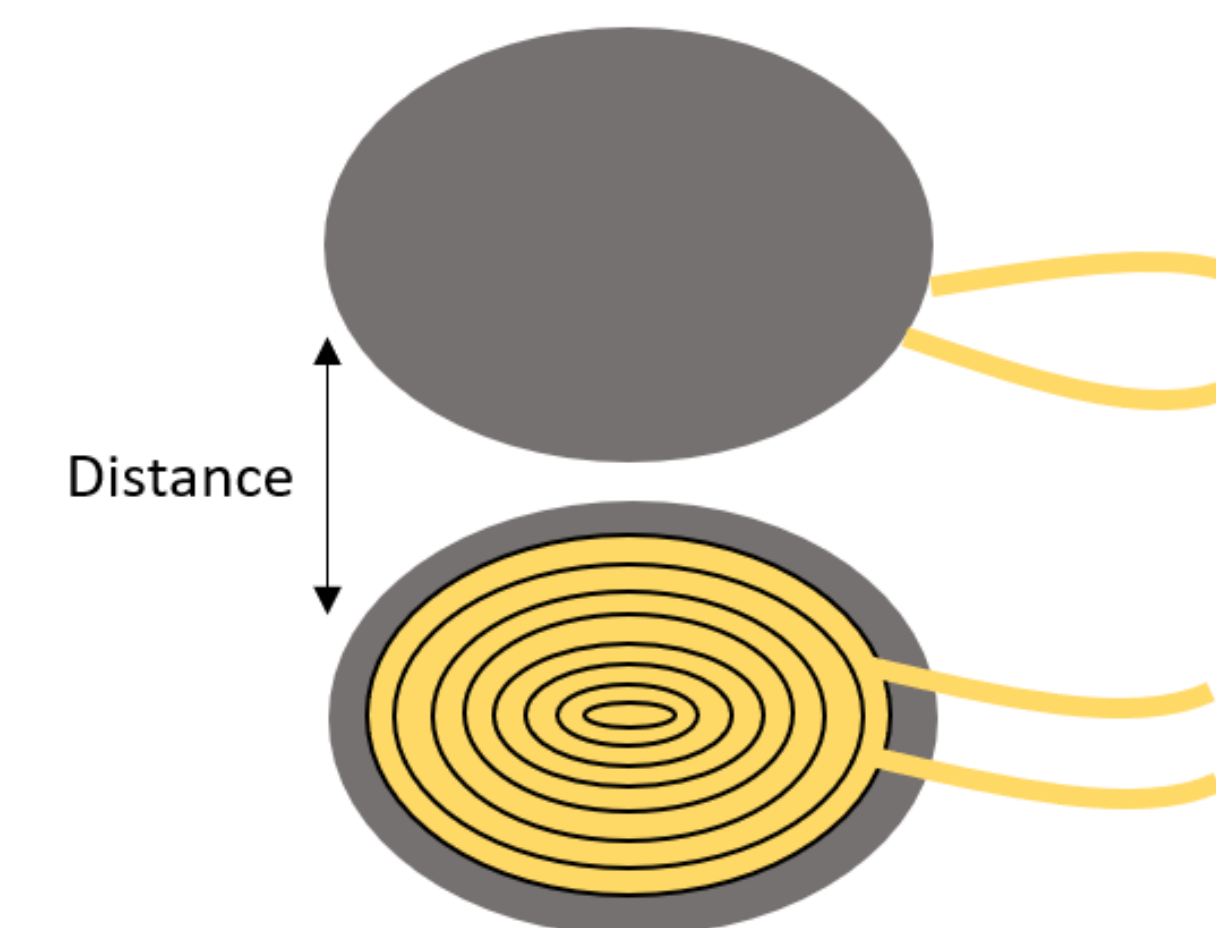
Principle

Several technologies are available in the literature. The resonant inductive coupling technology proved to be the most suitable for our application. The main idea is to couple both the transmitter and the receiver sides with capacitors tuned to resonate at the operating frequency.



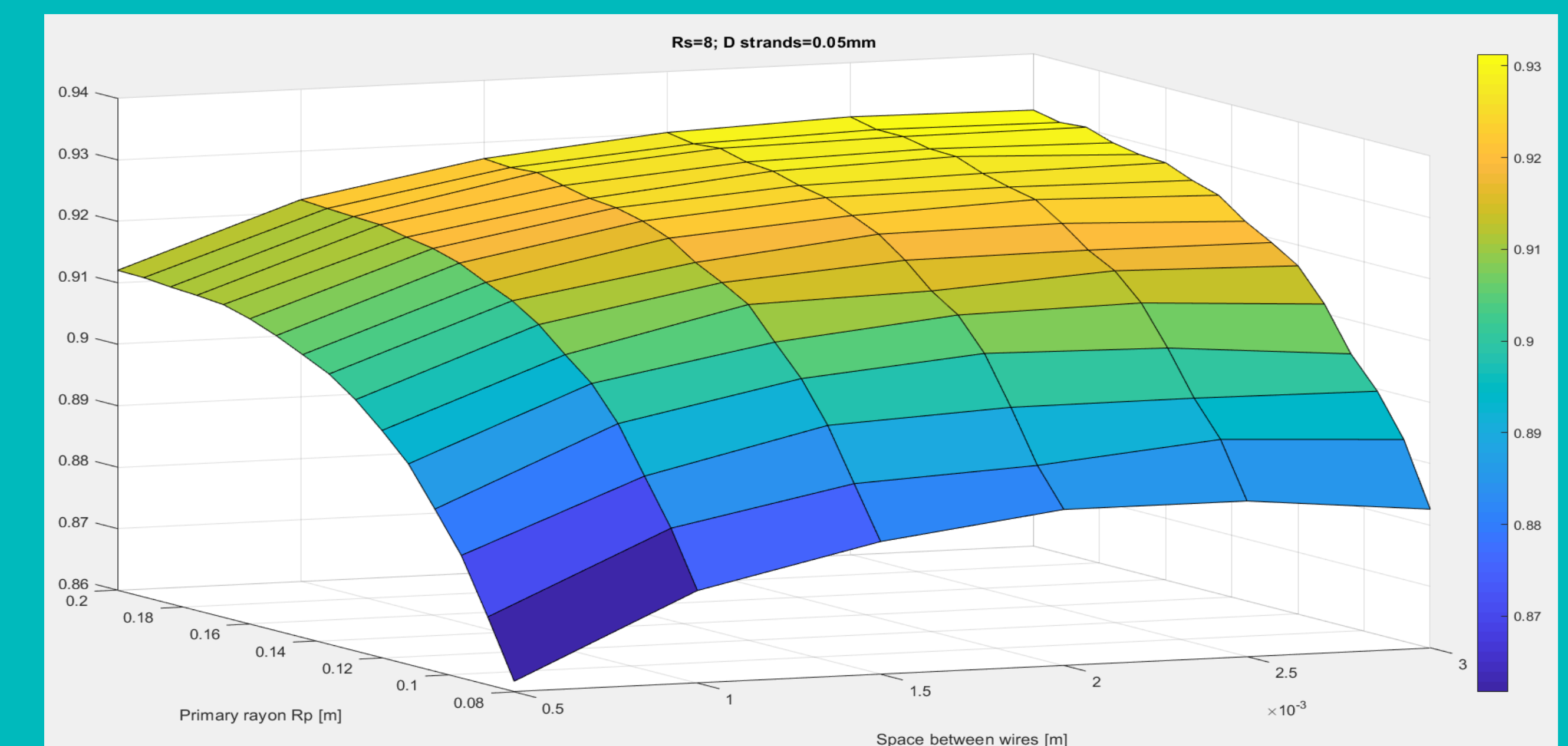
Analytical modeling

A complete analytical modeling of plate coils has been developed, which takes into account ferrit plates. The model is based on physical laws as Bios-Savart and Ampère's circuital laws. These laws have been used to compute the mutual inductance depending on coils physical constraints such as distance and misalignment. The model also computes the coils resistance taking into account the proximity effect. This allows to have an idea of the coils efficiency

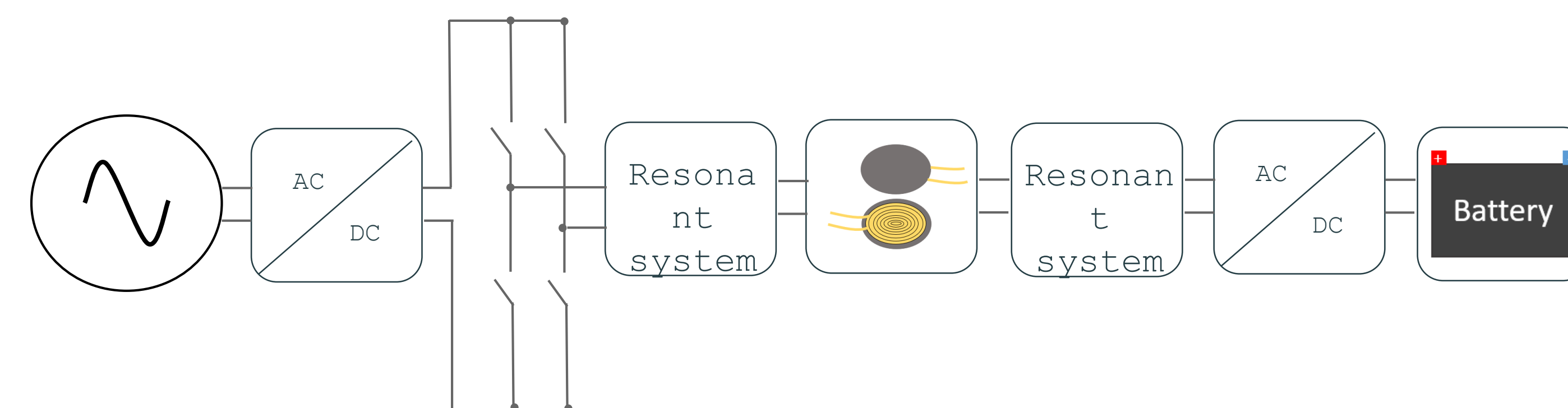


Results

The analytical model allowed to produce efficiency maps according to the coils physical design while considering physical constraints



Main architecture



A first prototype has been developed based on the architecture scheme, this prototype allowed to :

- Validate the main architecture
- Approve the choice of electronic components
- Implement a current control in order to charge batteries in constant-current mode (CC) and constant-voltage mode (CV)
- Start battery charging tests

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