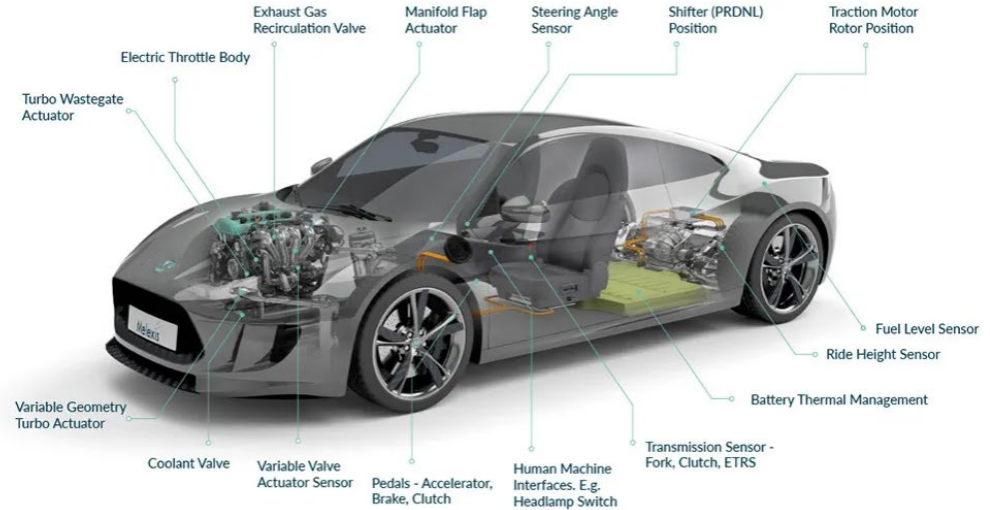
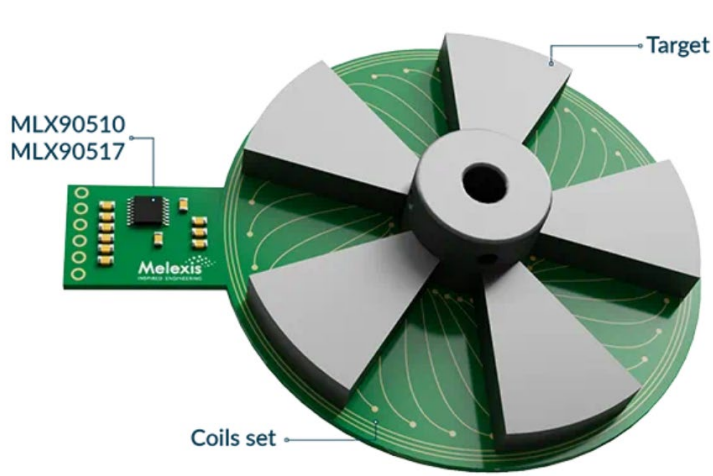


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Modeling PCB based Inductive Position sensors with the Comsol AC/DC module

Seriem Sid-Ahmed
Comsol Conference, 2023 Munich

Why PCB design is important ?



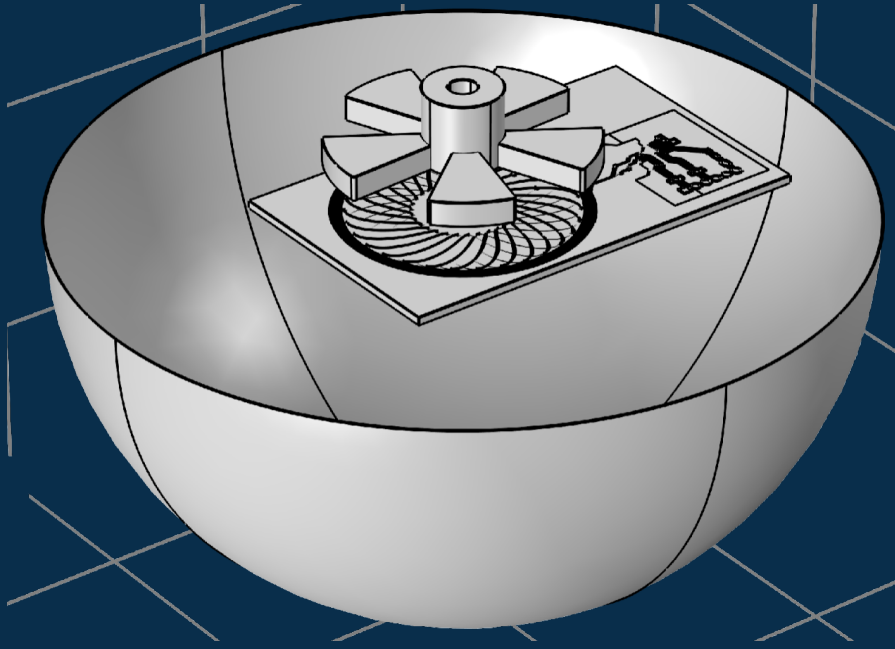
Key points for a position sensor :

- Safety
- Accuracy
- Size
- Price



PCB design
become critical !

Comsol implementation



ODB++ files from Altium are imported to Comsol using the **ECAD import module** and the **AC/DC module** of Comsol is used to perform the electromagnetic simulations.

Two sub-modules have been used :

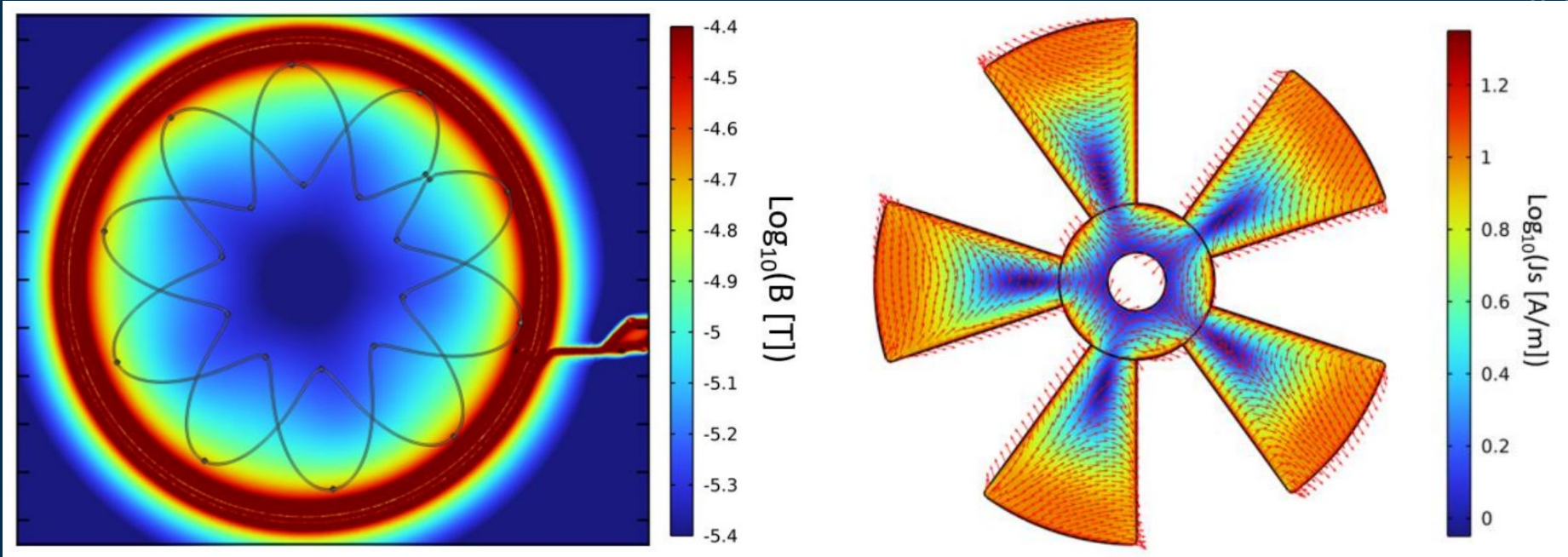
- **The Magnetic Fields Physics (mf)**

This module is used to define the boundary conditions and specify the operation of the different coils.

- **The Electrical Circuit Physics (cir)**

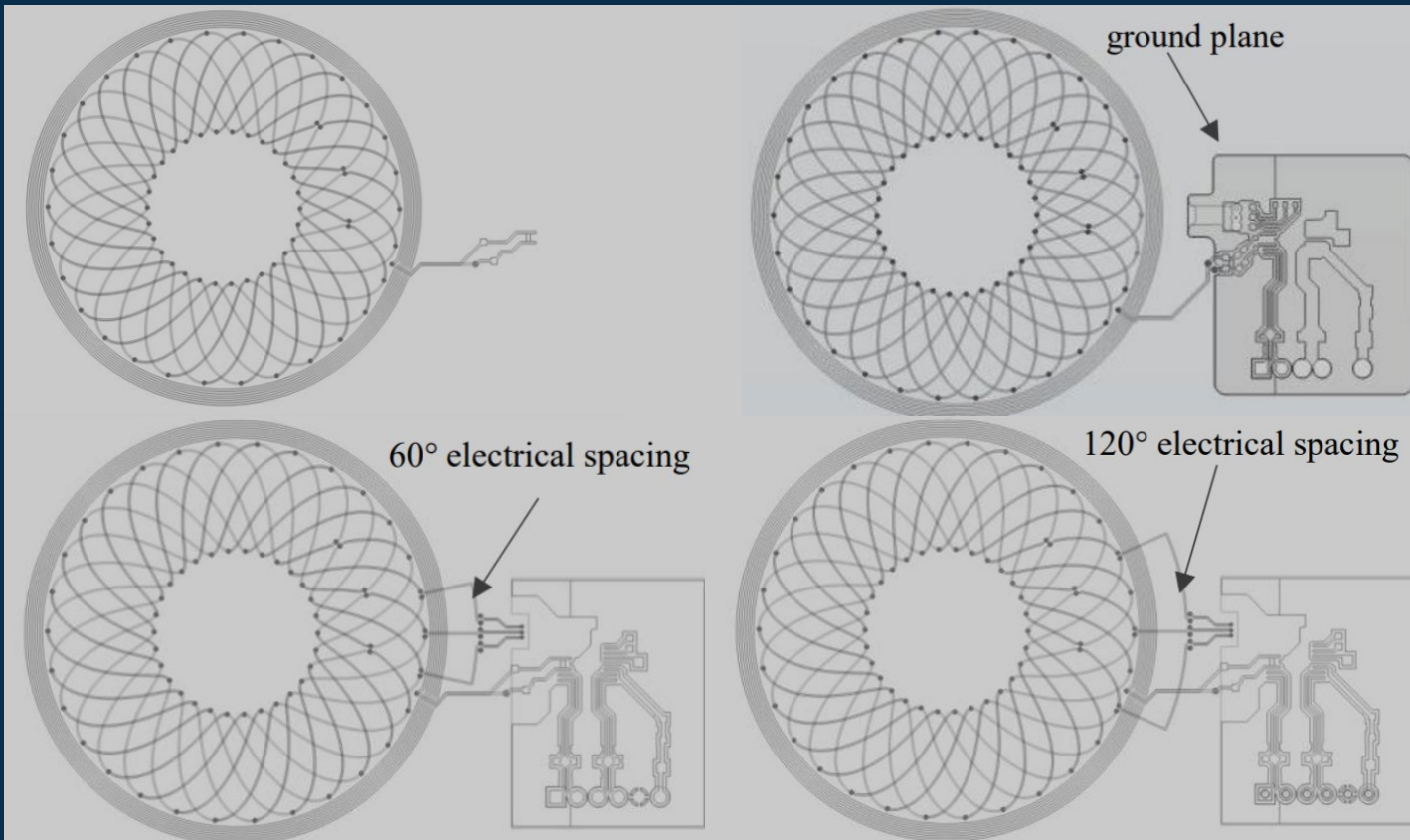
This module is used to introduce in the model the IC related aspects, in particular the driving of the Tx coil and the input impedance to which the Rx coils interface to.

Comsol results for a single configuration



We obtain three different voltages coming from the three receiving coils. After a Clarke transformation, we can retrieve the position of the target between 0 and 360 degrees.

Investigation



Conclusion

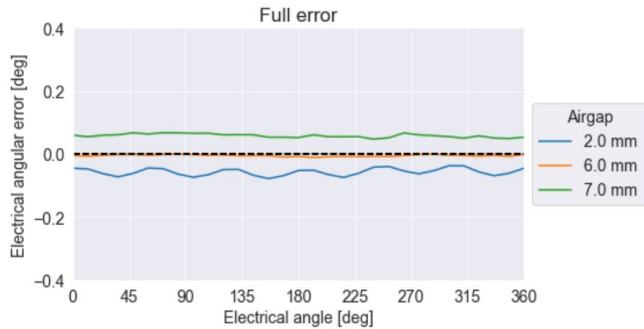


Figure 8. Sensor accuracy in ideal case – 4 layers

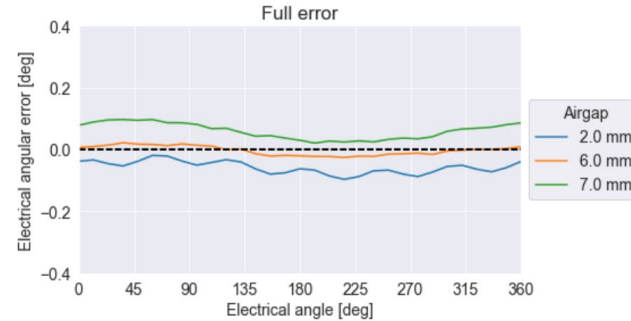


Figure 10. Sensor accuracy with ground plane – 4 layers

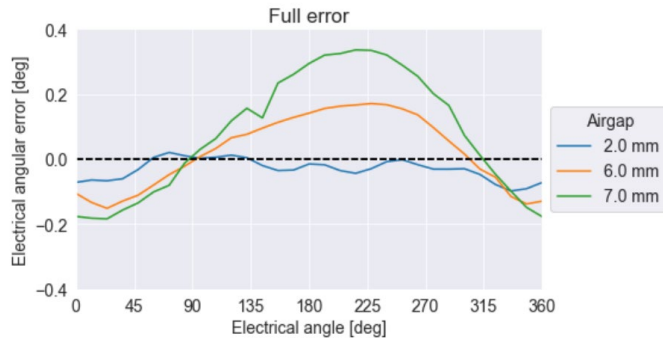


Figure 12. Accuracy with 60° electrical feedings – 4 layers

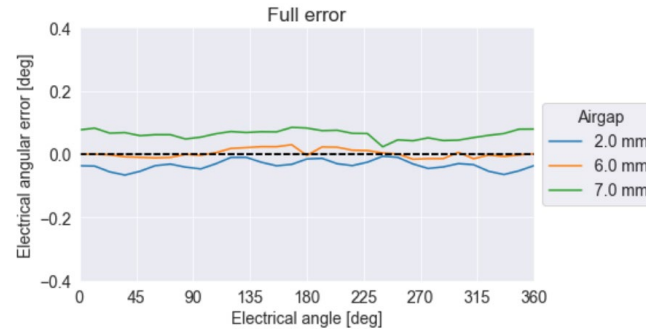


Figure 14. Accuracy with 120° electrical feedings – 4 layers

→ 4 layers PCB with 120 el. degrees feedings with a ground plane far away from the coils is the optimal choice to guarantee a high accuracy.

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Thank you for listening !