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Testing 3D modelling software.
Modelling charging pads for wireless power transfer (WPT) charging systems of electric vehicles. Magnetic emissions.

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Even for the experienced FEM modellers it may not be obvious which geometry discretization is the most appropriate and suitable for this type of problem. It may be a conservative approach to test the computation tool on a simplified geometry, on which the magnetic field distribution is known. As part of the "Metrology for inductive charging of electric vehicles" (MICEV) project (www.micev.eu), an axisymmetric geometry was used, with the results reported in the following.
This document reports a test case that can be useful for tuning an FEM code simulating the magnetic field generated by an IPT charging an electric vehicle. The test case was solved by several partners of MICEV and the results are reported below.
It is a WPT system with cylindrical symmetry that includes an aluminium screen, a ferrite concentrator, a transmitting coil (Tx coil) and a receiving coil (Rx coil). Figures 1 and 2 illustrate the geometry. The dimensions in Figure 2 are in mm.

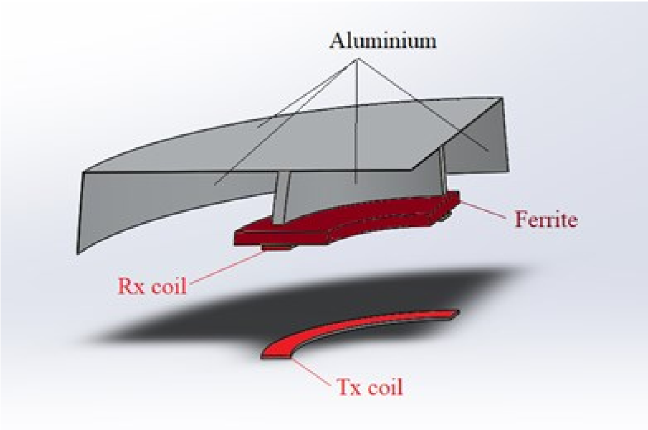

Figure. 1 - Double section (90 °) of the complete geometry (360°).

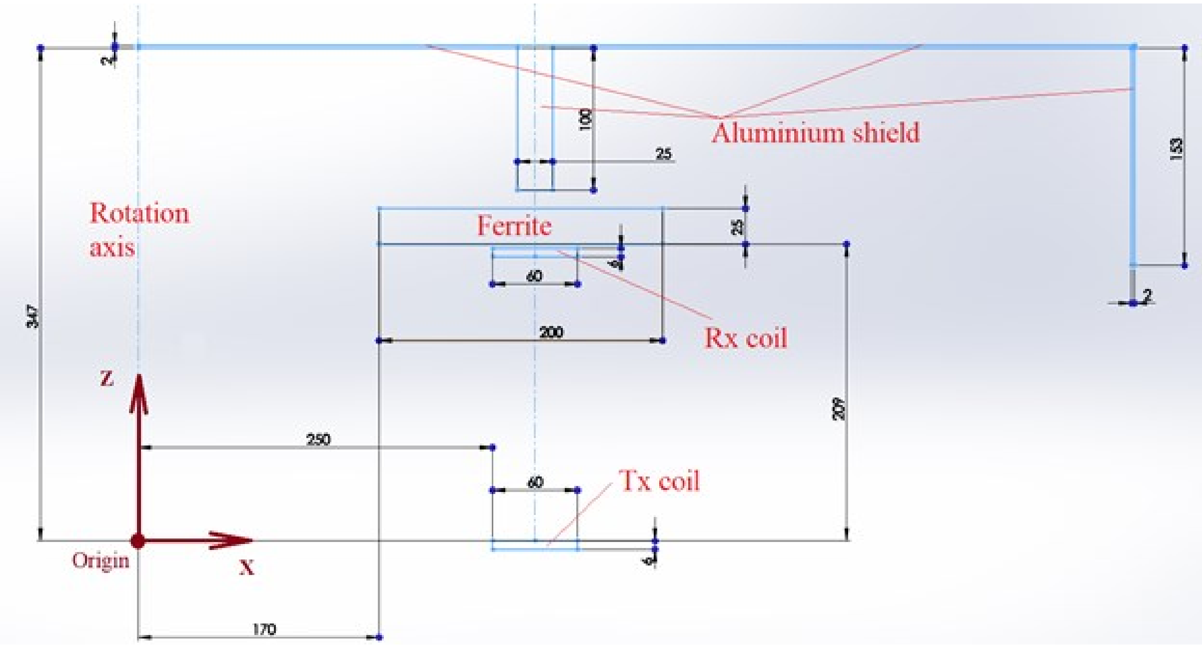

Figure. 2 – Basic geometry and dimensions in mm. The rotation axis is in the z axis.

The material properties are summarised in Table 1. Table 2 summarises the power conditions, including current levels. Figure 3 summarises the results along the investigation line oriented as follows: P1 (x = 1150; y = 0; z = 1150 mm), P2 (x = 1150; y = 0; z = 2000 mm).

Table 1 – Material properties.

Material	Conductivity (MS/m)	Relative permeability
Aluminium	33.45	1
Ferrite	0	2000

Table 2 – Coils properties.

Coil	r.m.s. Current (A)	Phase angle (degree)	no. of turns
Tx coil	50	0	10
Rx coil	105	-90	10

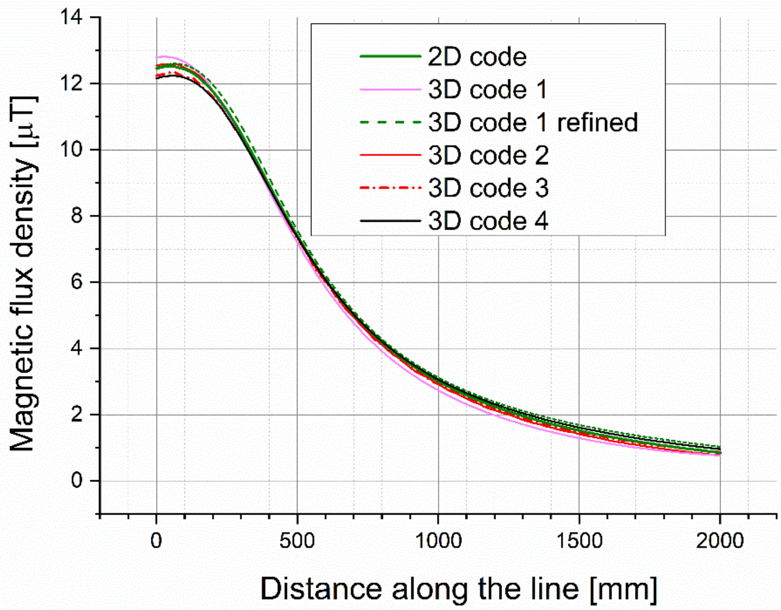

Figure 3 – Computational results (flux density r.m.s. values) from different partners of the MICEV project. Peak values differ up to 8%, depending on the mesh 3D and computational approach and convergence constraints.

The results are reported in the files:

- 2D_code.txt
- 3D_code1.txt
- 3D_code1_refined.txt
- 3D_code2.txt
- 3D_code3.txt
- 3D_code4.txt

The first column shows the distance in millimetres.
The second column shows the magnetic flux density in tesla.

All the datasets can be found at:
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