

# Study of Electromagnetic Shielding, a Comparison Between Experiment and FEM Simulation

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## Abstract

The loaded underground high voltage cable generates magnetic field with industrial frequency. Depending on the current rating and cable allocation, the magnetic exposure to public area may exceed the requested limit from customer. Extra shielding should then be applied. A primary FEM study shows that aluminum plate has a good shielding effect; the installation condition of the plate can however have an influence on it. For a detailed study, a complex experiment is constructed for a three phase cable system (Fig. 1). A 3D FEM model is built to simulate the experiment.

The Magnetic and Electric Fields interface of the AC/DC Module is used to calculate the magnetic flux density. To avoid the influence from other sources the experimental setup is on a large scale. It gives the challenge for meshing in 3D modeling. Edge current is applied to simulate the loaded current in cable, neglecting the detailed cable geometry.

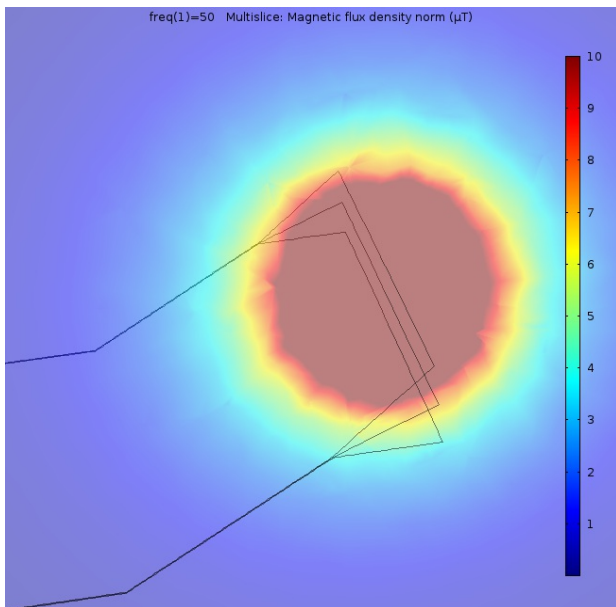
Fig. 2 shows the distribution of the magnetic flux density around the cables, which are loaded with 100 A current of 120 ° phase difference. The shielding effect using an Al plate can be seen in Fig. 3. The magnetic field at the area over the Al plate is strongly reduced. At the symmetric positions, the measured values are comparable to the simulated total magnetic flux density (mef.normB) for the case of symmetric loading, i.e. each phase loaded with the same amount of current. A big discrepancy is found, if the cables are asymmetrically loaded. A simple EMF meter of mono-axial is used in the experiment. It responses the magnetic field in a given direction. An isotropic probe is preferred for conducting the measurement. It gives the magnetic fields in all three directions and the total one and will make it easier for the comparison to simulation.

A 3D model is built for simulation the experiment of electromagnetic shielding. The simulated result can explain the experimental data. An isotropic probe will make it easier either for the measurement or for the comparison to simulation.

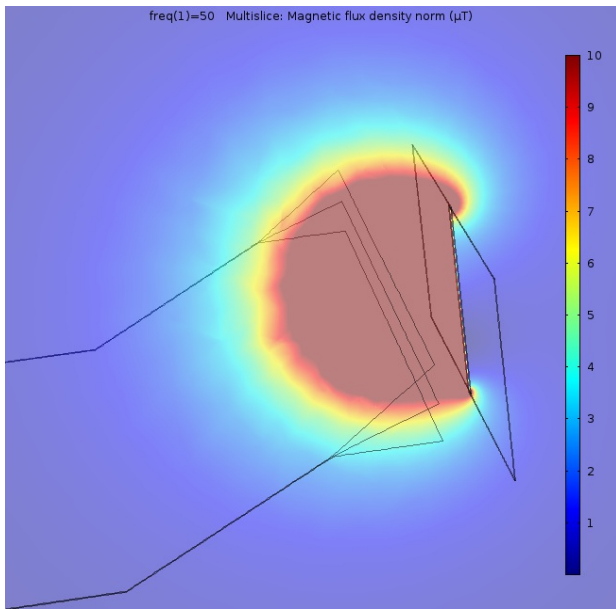
## Figures used in the abstract



**Figure 1:** Experimental setup for measuring the effect of Al plate for shielding the magnetic field from a three phase cable system.



**Figure 2:** Simulated magnetic field distribution around the loaded cables, without use of an Al plate.



**Figure 3:** Simulated magnetic field distribution around the loaded cables, with the use of an Al plate.