

High Voltage Testing and Engineering Commission
Fachkommission für Hochspannungsfragen
Calculation methods for power engineering

FKH has a range of technical calculation methods and software tools that it uses for studies and investigations of design issues, with the focus on these aspects in particular:

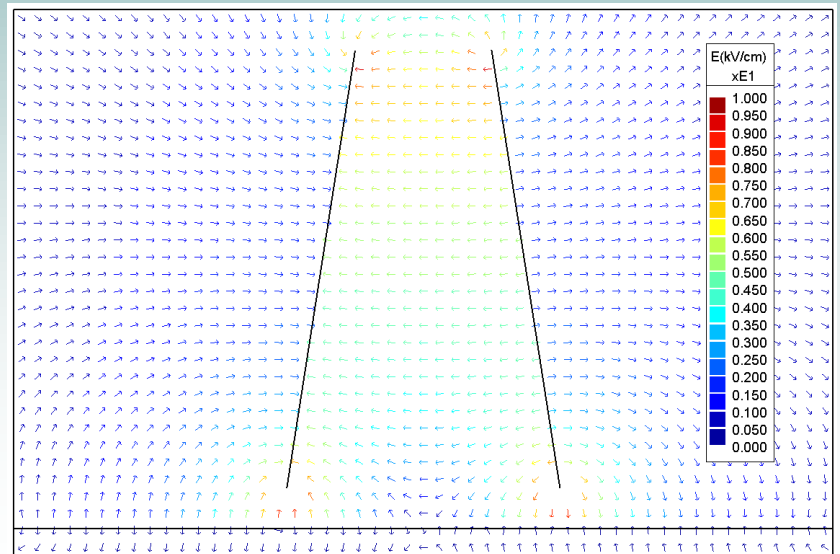
- ⇒ Design or in-service behaviour of high-voltage electrical equipment and installations
- ⇒ Electromagnetic emissions and interference issues

Examples of our calculation tools include:

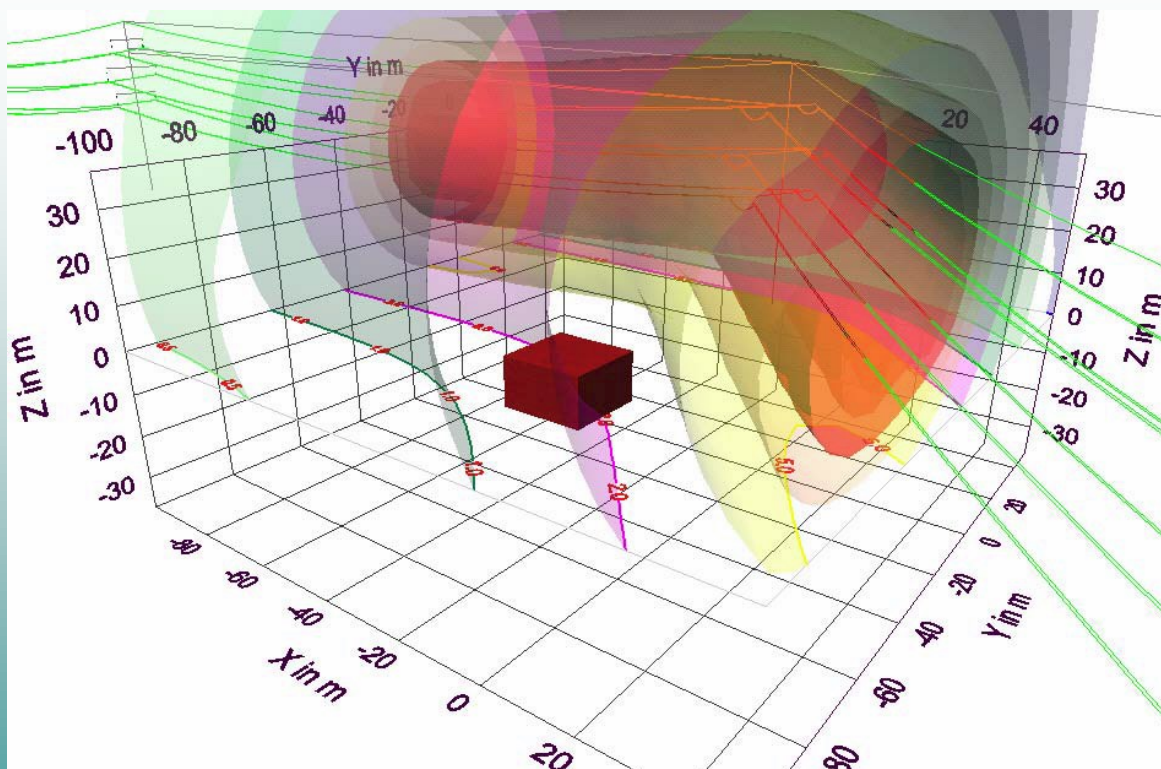
E- and B-field calculation software

Electrical and magnetic fields are key factors in the dimensioning of insulation systems, and they are equally important in connection with environmental compatibility issues.

FKH also uses calculation software for problems involving dielectric and magnetic materials, skin effect current and/or eddy currents.



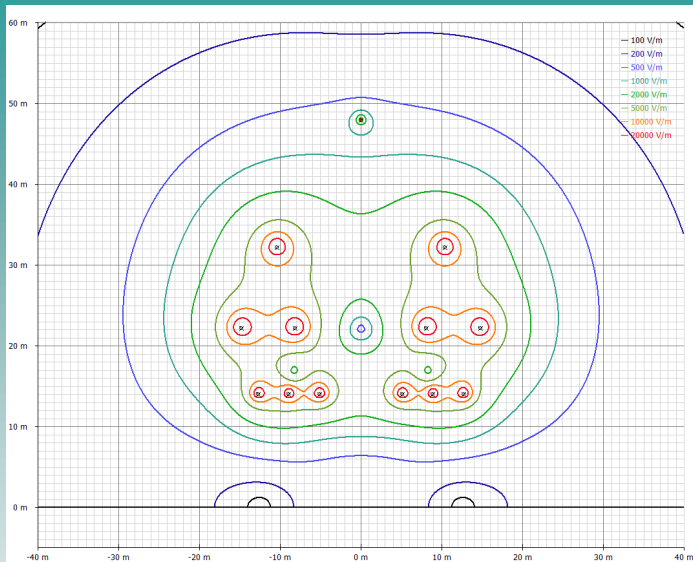
The result of a two-dimensional calculation of the electrostatic field in a plate electrode system. The field direction is shown as a direction vector and colour coding is used to indicate the field strength



The result of a three-dimensional calculation of the magnetic flux density in the area surrounding an angle in a 220 kV overhead line. Areas with equal magnetic flux density are shown

The FKH EBL program

This program calculates the two-dimensional electrical and magnetic fields of overhead lines as well as corona sound emissions and emissions from high-frequency electromagnetic fields.

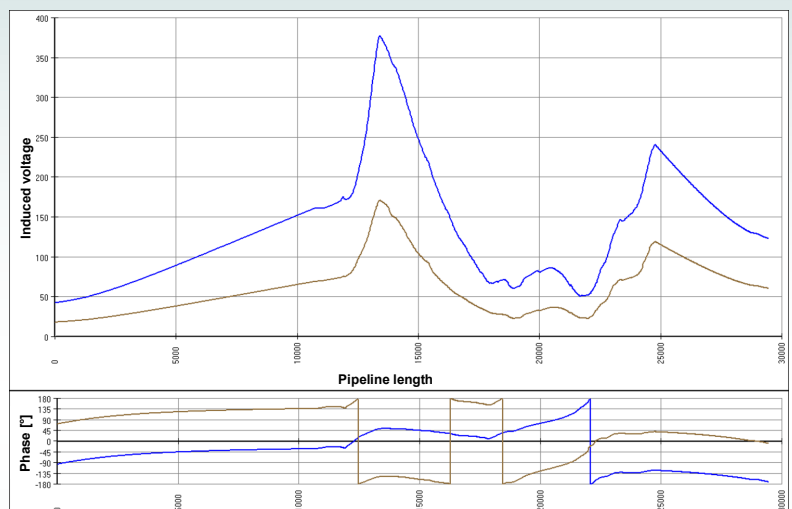


Cross-sectional view showing lines with equal electrical field strength for an overhead line with two 220 kV systems and two 110 kV systems

The FKH low-frequency interference program (LFIP)

After route maps for electrical power lines, communication cables or pipelines have been imported into this program, it can calculate the induced voltages for the influenced lines both during normal operation and in case of a fault.

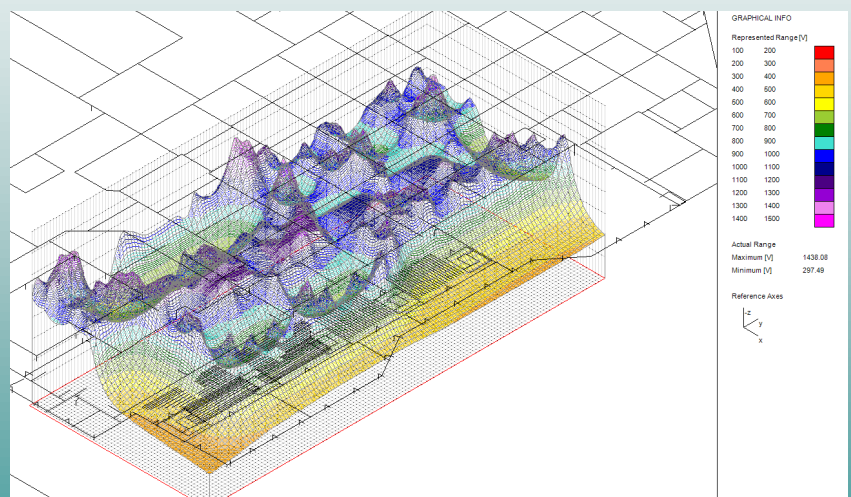
Gradient of the induced voltage along a cathodically protected pipeline with various AC decoupling devices



Software for grounding calculations

FKH offers grounding calculations, with evaluations, to verify the effectiveness of grounding systems for substations and other electrical installations. Knowledge of the specific ground resistivity is a prerequisite for the theoretical analysis of a grounding system. A grounding calculation comprises these steps:

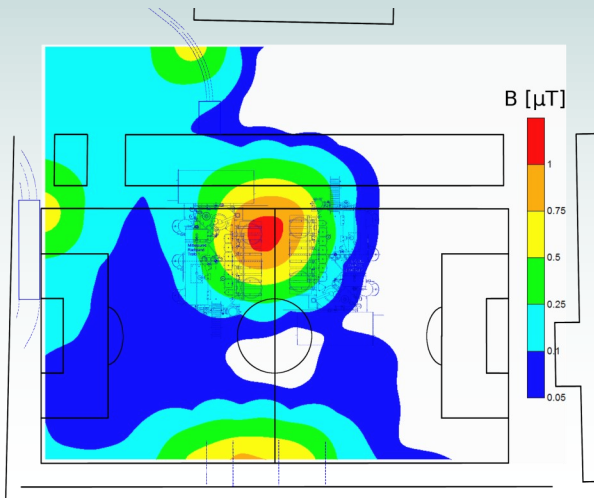
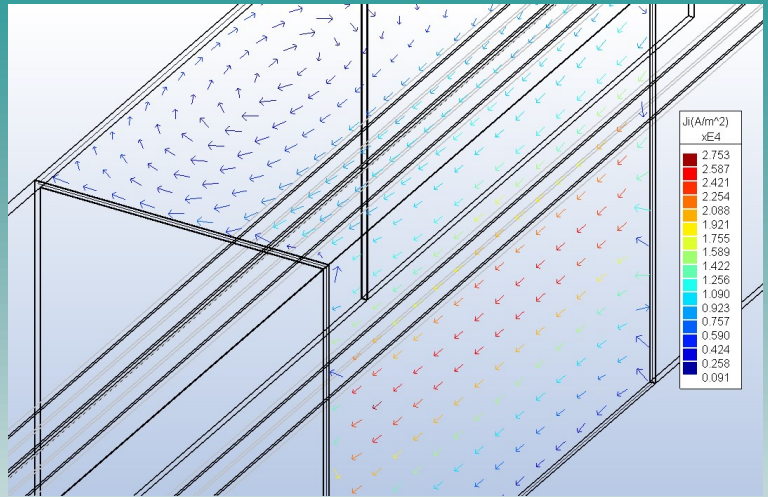
- ⇒ Modelling of the grounding system and input of the specific ground resistivity values measured beforehand
- ⇒ Calculation of the grounding resistance and ground potential distribution
- ⇒ Calculation of the touch and step voltages
- ⇒ Calculation of the ground fault current distribution
- ⇒ Documentation and report



Result of a grounding calculation: grounding potential shown as a three-dimensional colour-coded area

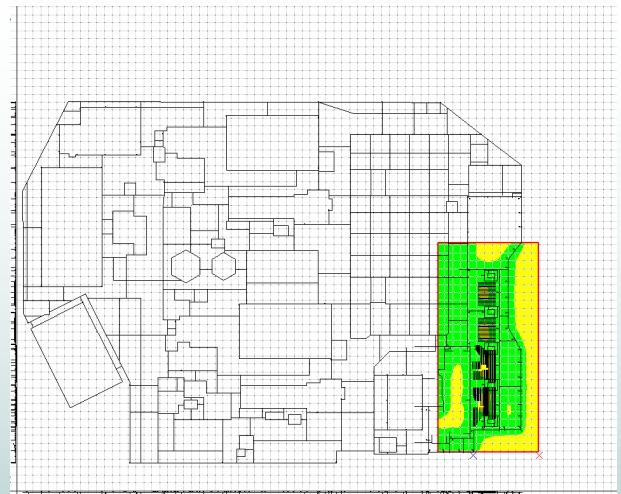
Three-dimensional simulation of eddy current distribution in the shielding of a high-voltage cable line

The diagram shows the direction and intensity of the eddy currents in the centre of the aluminium shielding, which has a thickness of 10 mm



Ground plan of a sports field above an underground substation. The boundaries between the areas shaded in different colours represent lines of equal magnetic flux density

Result of a grounding calculation for a large power plant site. The touch voltages are not respected in the areas with yellow colour shading



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