

# An App for Calculating the Electric Field Outside Electrical Installations

N. Lavesson<sup>1</sup>

<sup>1</sup>ABB Corporate Research, Västerås, Sweden

## Abstract

It is becoming more common to see requirements on electric field levels near electrical equipment in areas which people are allowed access. This development is driven by an increased concern with health and safety and stricter regulatory requirements. These requirements need to be taken into account when designing electrical installations such as substations, FACTS and capacitor banks. The verification of the electric field level is normally done through simulation. The problem is simple enough that for most purposes a simulation with an idealized geometry is sufficient, but not simple enough to allow for the use of analytical formulas.

COMSOL Multiphysics® software is used to construct an app for automating the calculation. This serves the purpose of making the simulation directly available to the engineer working on the station design without having to contact a simulation expert. The app is based on an electrostatic calculation of an axisymmetric geometry of a station consisting of a platform surrounded by two fences (one for authorized staff and one for the general public), which can be used to approximate many common designs. The dimensions, voltage levels and allowed fields are parameters of the app. The app can quickly calculate the electric field and check if it conforms to the allowed level and it also has the option of automatically generating a report with all input data and results.

The results from the app are compared to a three-dimensional model for a representative case. It is found that the results are accurate although somewhat conservative. The quality of the solution is therefore considered good enough to be used directly with a customer project while more advanced 3D simulations can be used as a compliment if further optimization of the station layout is desired.

To conclude the implemented app fulfills the target of a simple method for verifying that the electric field levels are below the required levels near fenced electrical equipment. The results are shown to be good enough for most cases and can be complemented with more detailed calculations if desired. When implemented in the workflow the app is expected to significantly cut the time needed to validate a station design.

## Reference

- [1] International Commission on Non-Ionizing Radiation Protection and ICNIRP ELF Task Group, Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz), Health Physics, 99(6), pp. 818-836 (2010)
- [2] IEEE, IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields 0–3 kHz, IEEE Std C95.6 (2002)
- [3] Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields), Official Journal of the European Union, L 179/1 (2013)

## Figures used in the abstract

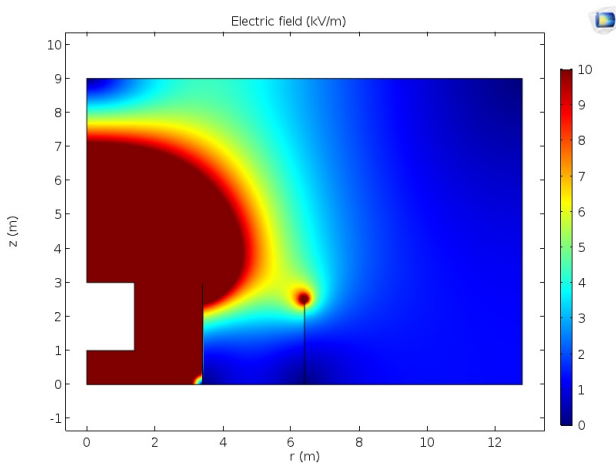


Figure 1: Electric field outside typical station layout.

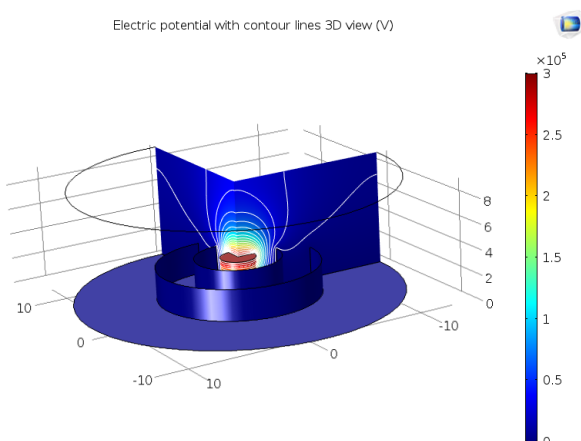


Figure 2: 3D view of the axisymmetric geometry.

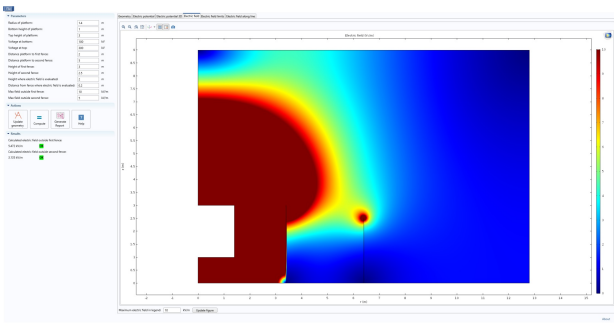


Figure 3: The app viewed in the browser.