A Grounding Application

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Computer simulation of grounding applications are important for power generation and distribution. INTEGRATED's proprietary **Boundary Element Method (BEM) solver** simulates various types of grounding scenarios very efficiently, especially in the HVDC domain of power/energy industries and in applications involving open regions for electromagnetic field computations.

Below is a case, where INTEGRATED's **COULOMB** has been used to simulate a HVDC grounding system. The model consists of 648 volumes, which have been assigned specific conductivities. This demonstrates the software's capability of assigning and managing materials with various conductivity values. **COULOMB** is the industry standard program to solve conductivity mode problems for electric field analysis. The HV electrode shown in blue (center) is placed in the central part of the first layer and is assigned a voltage of **400 kV**. The layers have been modeled as per the numbers inscribed vertically on the left with their specific conductivity values assigned to them. These values are made available from geological surveys of earth samples. The radius of the complete cylinder is two kilometers with approximately an equivalent height. This model takes less than 15 minutes to solve on a 64-bit Windows dual core computer provided the RAM available is 24 GB or more.

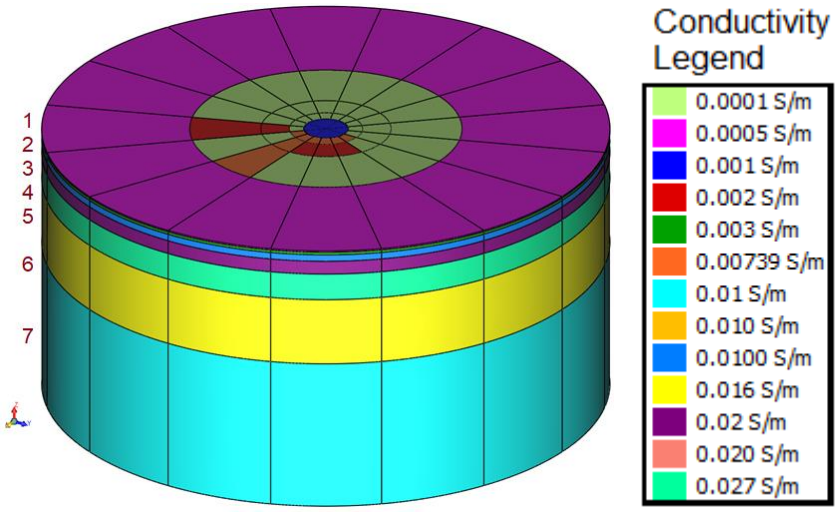

Fig.1: Fundamental model with different layers of conductivities (S/m) assigned along with color codes

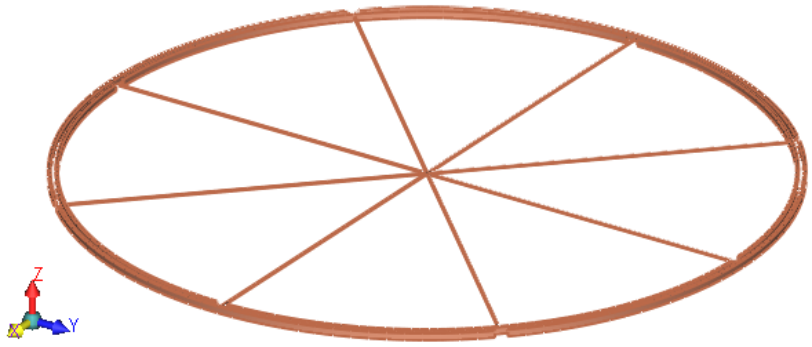

Fig. 2: 3D view of the central HV electrode. Thickness of electrode = 3 meters

We present various analysis results for the above model. These are only basic sample computations. More specific and detailed computations for a variety of parameters are possible.

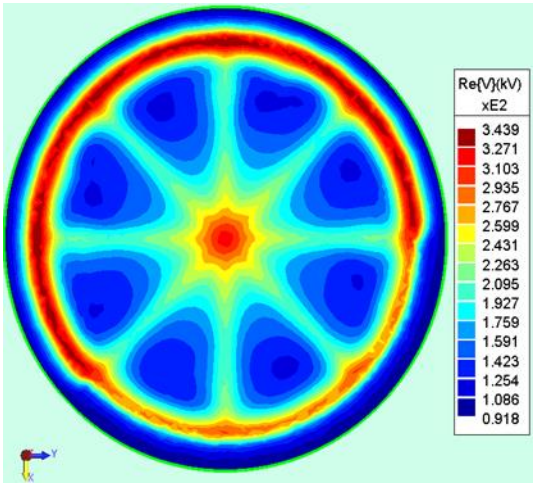

Fig. 3: Voltage contour plot, a meter above ground level for a 400-meter circular region around the HV electrode

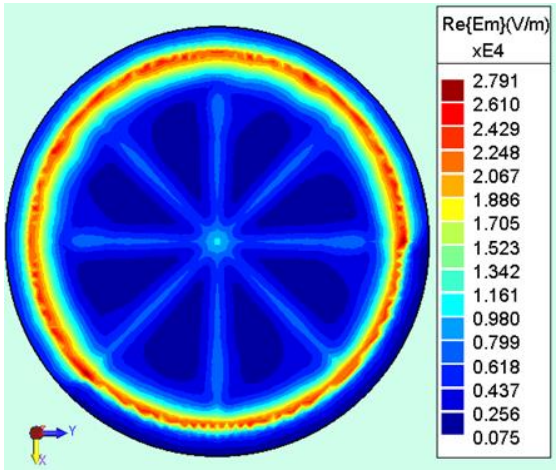

Fig. 4: Electric field contour plot, a meter above ground level for a 400-meter circular region around the HV electrode

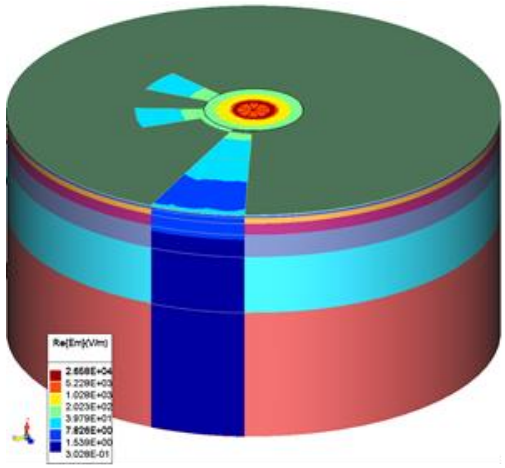

Fig. 6: Electric field results using a log scale on surfaces with different conductivity values in radial direction

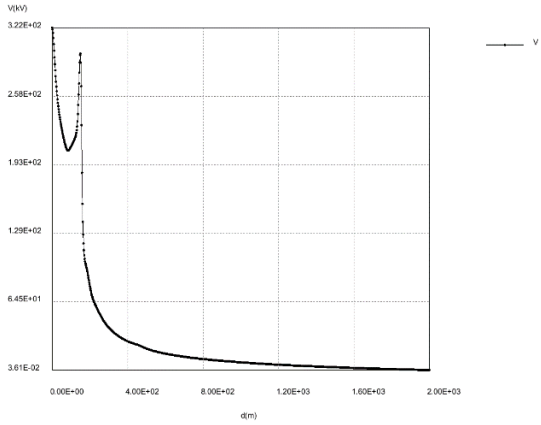

Fig. 5: Voltage result along radial direction with radius = 2 kms

Voltage and Electric fields can be further computed and analyzed in azimuthal (phi) directions like the radial ones. Each sector shown alongside in Fig. 4 is 22.5 degrees with 16 sectors in total.

COULOMB can also be controlled externally using API (Application Programming Interface). An API script to create a very similar 3D geometry and material assignments is available in Excel-VBA and Python 3. Using these types of applications (API scripts), the model creation can be achieved very quickly and efficiently.