An Electrostatic Simulation of a Surge Arrester

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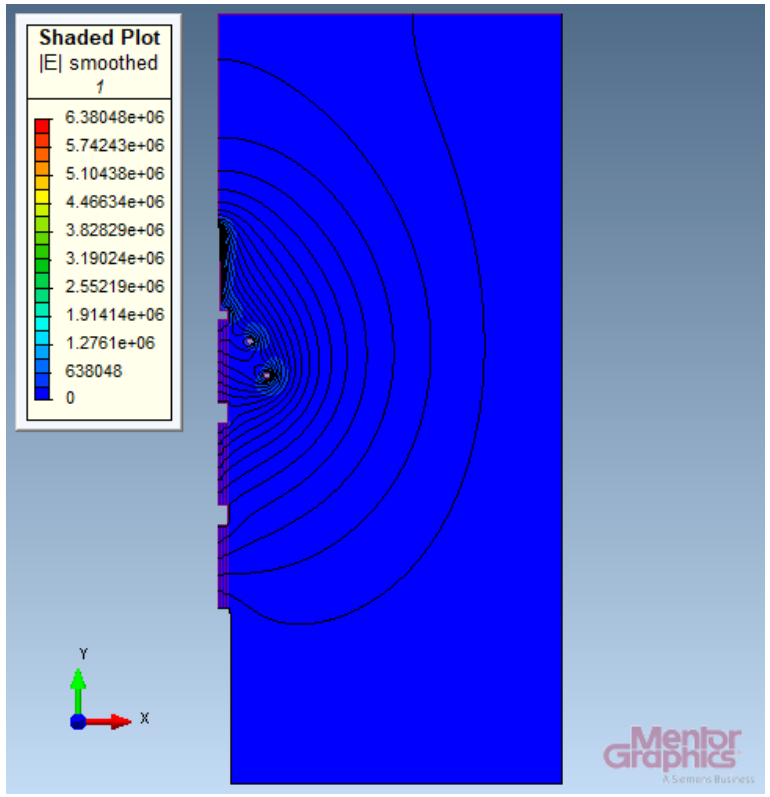
This surge arrester example is based on a document from the International Electrotechnical Commission: "Guide for the determination of voltage distribution along the length of metal-oxide surge arresters". The ElecNet simulation presented here was compared to results provided in this document.

This surge arrester has 2 grading rings. It is formed of 2 electrodes: one at the top formed by a conducting metal rod and 2 conducting metal grading rings, and the other at the bottom forming the pedestal of the surge arrester.

The potential of the top electrode and grading rings was set to 333 kV. The potential of the pedestal was set to 0. In between the 2 electrodes there are metal-oxide resistors surrounded by a porcelain housing. Metal disks separate the resistor-porcelain units.

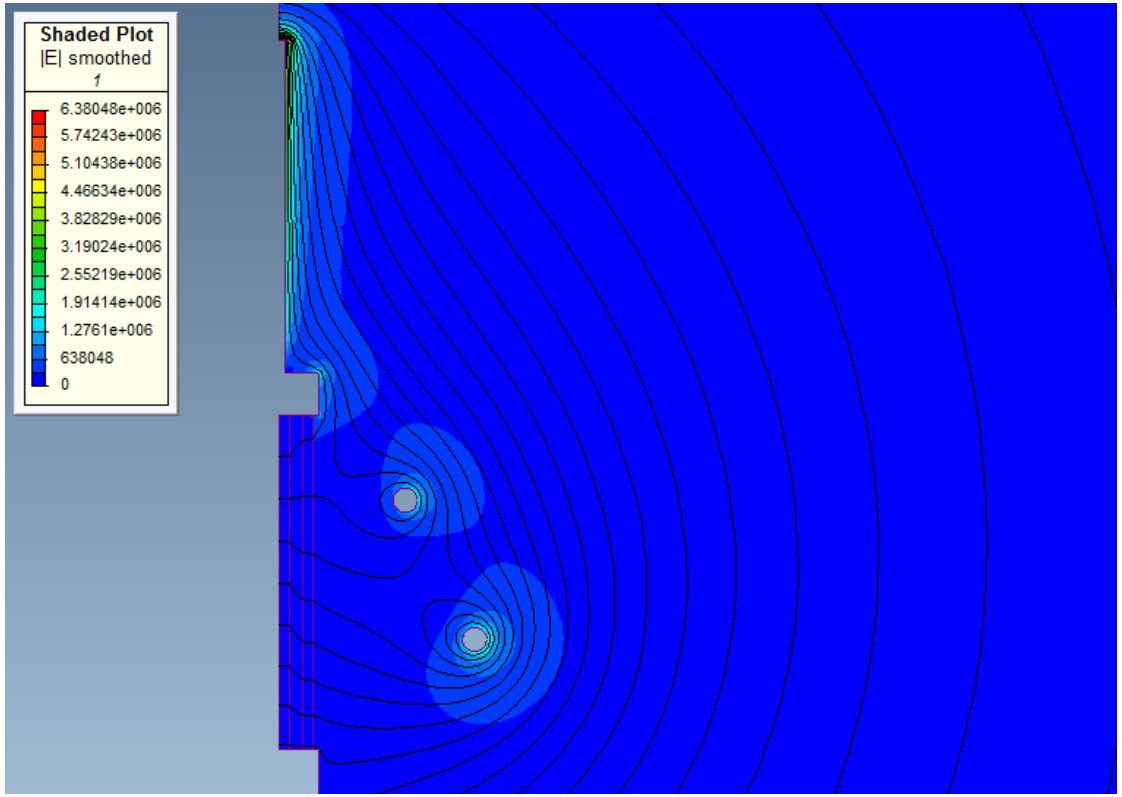
The outer radial boundary of the model was set to ground potential. The metal-oxide resistors were given a relative permittivity of 800, while a permittivity of 5 was chosen for the porcelain housings.

POTENTIAL FIELD AND ELECTRIC FIELD INTENSITY



Contour plot of the potential field, as well as a shaded region plot of the electric field intensity of the surge arrester as simulated in ElecNet.

CLOSER INSPECTION OF THE FIELDS



A magnified view of the electric field intensity and of the contours of constant potential in the region of the top electrode is shown here.

VOLTAGE STRESS

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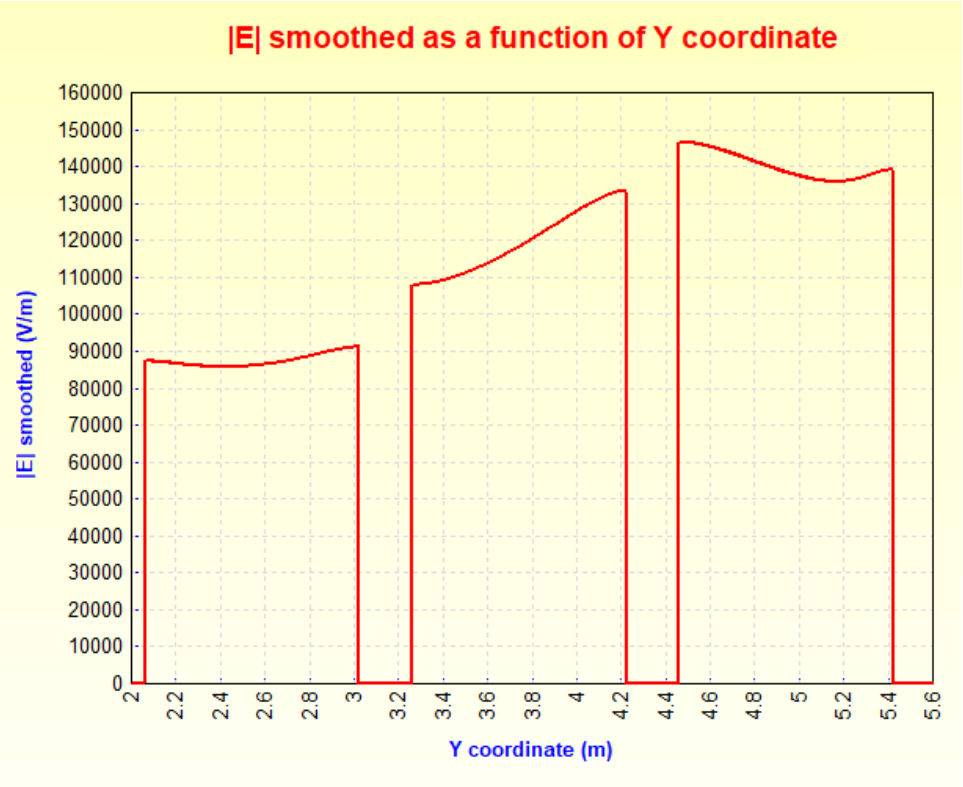

This graph displays the voltage stress, as a function of position, along the length of the metal-oxide resistor chain, measured midway between the center and the surface of the resistor.

POSITION OF THE PLUNGER

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	Maximum Voltage Stress			Maximum Ratio
	Top Unit	Middle Unit	Bottom Unit	
	%/m	%/m	%/m	Per Unit
ElecNet Result	44.02	40.02	27.32	1.2689
IEC Result	44	40	27	1.27

The IEC procedure also quotes the maximum stress in each metal-oxide resistor unit, as a ratio of the maximum voltage stress, with respect to the applied voltage difference (333 kV). The results are summarized in the table above.