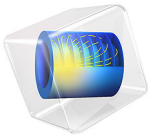

Position Optimization of Grading Rings

Introduction

This model extends the model High Voltage Insulator in the AC/DC Module Application Library by adding an Optimization study node. The Optimization study is aimed at finding the optimum position of the grading rings to obtain the highest flashover voltage.

Model Definition

In this model, a boundary probe defining the maximum value of the vertical component of the tangential electric field of the high voltage insulator is first created. The boundary probe is then set as the Objective Function. The control variables are the diameter of the grading ring and the distance from the end.

Results and Discussion

Figure 1 compares the vertical component of the tangential electric field along the first six sheds from the line end under different conditions. It is shown that the maximum of the tangential electric field is further reduced with the use of the Optimization study.

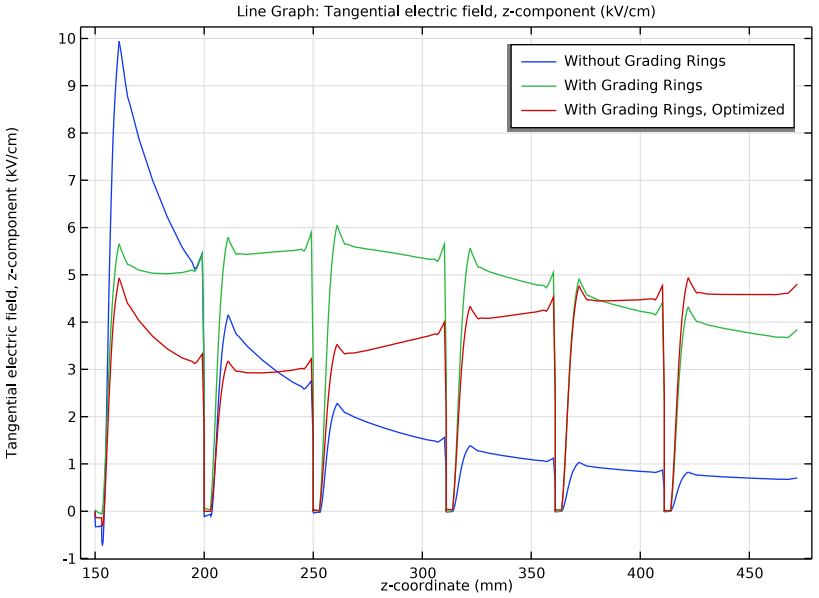

Figure 1: Comparison of the z-component of the tangential electric field along the surface of the first six sheds from the line end in different cases.

Application Library path: `ACDC_Module/Electromagnetics_and_Optimization/grading_ring_optimization`

Modeling Instructions

ROOT

In this model version you determine the optimum position of the grading rings by using an **Optimization** study node.

APPLICATION LIBRARIES

1 From the **File** menu, choose **Application Libraries**.

2 In the **Application Libraries** window, select **ACDC Module>Devices, Capacitive> high_voltage_insulator** in the tree.

3 Click **Open**.

ADD STUDY

1 In the **Home** toolbar, click **Add Study** to open the **Add Study** window.

2 Go to the **Add Study** window.

3 Find the **Studies** subsection. In the **Select Study** tree, select **General Studies>Stationary**.

4 Click **Add Study** in the window toolbar.

5 In the **Home** toolbar, click **Add Study** to close the **Add Study** window.

STUDY 3

Optimization

In the **Study** toolbar, click **Optimization** and choose **Optimization**.

COMPONENT 1 (COMP1)

In the **Model Builder** window, expand the **Component 1 (comp1)** node.

DEFINITIONS

Boundary Probe 1 (bnd1)

1 In the **Model Builder** window, expand the **Component 1 (comp1)>Definitions** node.

2 Right-click **Definitions** and choose **Probes>Boundary Probe**.

3 In the **Settings** window for **Boundary Probe**, locate the **Probe Type** section.

4 From the **Type** list, choose **Maximum**.

5 Locate the **Source Selection** section. From the **Selection** list, choose **Shed Surface**.

6 Locate the **Expression** section. In the **Expression** text field, type `es.tEz`.

7 In the **Table and plot unit** field, type `kV/cm`.

STUDY 3

Optimization

1 In the **Model Builder** window, under **Study 3** click **Optimization**.

2 In the **Settings** window for **Optimization**, click **Add Expression** in the upper-right corner of the **Objective Function** section. From the menu, choose **Component 1 (comp1)> Definitions>comp1.bnd1 - Boundary Probe 1 - V/m**.

3 Locate the **Control Variables and Parameters** section. Click **Add** twice.

4 In the table, enter the following settings:

Parameter name	Initial value	Scale	Lower bound	Upper bound
D (Diameter of the grading ring)	350[mm]	1[m]	200[mm]	1000[mm]
d (Distance of the grading ring from the end)	150[mm]	1[m]	10[mm]	500[mm]

5 In the **Home** toolbar, click **Compute**.

OBJECTIVE TABLE 3

1 Go to the **Objective Table 3** window.

2 Click **Display Probe Table 1** in the window toolbar.

RESULTS

With Grading Rings

1 In the **Model Builder** window, expand the **Results>Tangential Electric Field, z-Component** node.

2 Right-click **With Grading Rings** and choose **Duplicate**.

With Grading Rings, Optimized

1 In the **Model Builder** window, under **Results>Tangential Electric Field, z-Component** click **With Grading Rings 1**.

2 In the **Settings** window for **Line Graph**, type `With Grading Rings, Optimized` in the **Label** text field.

3 Locate the **Data** section. From the **Dataset** list, choose **Study 3/ Parametric Solutions 1 (sol4)**.

4 From the **Parameter selection (D, d)** list, choose **From list**.

5 Locate the **Selection** section. From the **Selection** list, choose **Shed Surface**.

6 In the **Tangential Electric Field, z-Component** toolbar, click **Plot**.

Tangential Electric Field, z-Component

1 In the **Model Builder** window, click **Tangential Electric Field, z-Component**.

2 Click **Plot**.

3 Click the **Zoom Extents** button in the **Graphics** toolbar.