

# COMSOL Project

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## Cylindrical Capacitor Design

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### Description of Parameters Section

R: This represents the radius of the cylinder. Define this parameter for both Cylinder 1 and Cylinder 2.

L: This is the length of the cylinder, and it should be defined for both Cylinder 1 and Cylinder 2.

V1: This is the voltage applied to the lower semi-cylinder.

V2: This is the voltage applied to the upper semi-cylinder.

E0: Refers to the Relative Permittivity, which can be found in the Charge Conversation page.

Note: Before introducing the next two parameters, it should be mentioned that to account for infinity and consider the field and potential outside the system, a spherical air layer around the capacitor must be included.

R<sub>air</sub>: As mentioned earlier, to ensure that the spherical layer always remains outside the capacitor, its radius is defined as  $R + L$ . This is the radius of Shape1.

Z<sub>air</sub>: To ensure that this spherical air layer is at the center of the cylinder, its z-component is considered to be half of the cylinder's height, and it is set in the z-component of Shape1.

### Description of the Geometry Section

Cylinder1: This is the outer surface with radius R and height L, defined as a Surface with a thin thickness.

Cylinder2: This is defined as a Solid with radius R and height L, and it represents the dielectric volume.

Shape1: Its explanation is provided in the "Note" section.

### Definitions

Proceed as follows:

Definitions → Selections → Explicit

To make the work easier, define the upper semi-cylinder as Upper Layer, the lower semi-cylinder as Bottom Layer, the air sphere as Air, and the dielectric volume as Dielectric.

## Materials

Assign the materials as follows:

Assign copper to the Upper Layer and Bottom Layer, which surround the dielectric like a shell.

Assign air to the dielectric and the air sphere.

## Physics

Create two Electric Potential conditions and assign the corresponding potentials to the plates:

V2 for the upper plate

V1 for the lower plate

## Mesh

To prevent the file size from becoming too large while maintaining an acceptable output, you can set the Element Size to Fine.

## Study

Use the Parametric Sweep command, assign the parameters their respective values, and then click on Compute to obtain the output.