nclab
Online STEM Laboratory

Parallel Plate Capacitor

Based on Hermes2D (`http://hpfem.org/hermes`)

1 Module Description

The parallel plate capacitor model calculates the distribution of the electric potential φ induced by stationary electric charges on the two plates of the capacitor. User-defined parameters include the dimensions of the capacitor (the radius of the plates r, or the area of the plates S, and the distance between the plates d), relative permittivity of the dielectric ϵ_r, and the two voltages.

The image below shows a historical model of a parallel plate capacitor with white-colored dielectric between the plates.

Figure 1: Parallel plate capacitor.

2 Underlying Equations

The equation for the electric potential φ is

$$-\mathrm{div}(\epsilon \nabla \varphi) = \varrho$$

where ϱ is electric charge density. Once the electric potential φ is calculated, the electric field vector E can be obtained as its negative gradient,

$$E = -\nabla \varphi.$$