

Electric Field in the Ovoid-Shaped Dielectric

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Abstract: In nature are quite present ovoid-shaped of the dielectric. Using the method of fictitious sources we can determine the electric field inside the ovoid-shaped dielectric.

Keywords: Ovoid-shaped dielectric, Method of fictitious sources.

1 Introduction

A variety of dielectric forms for storing different resources, such as water, gas, fuel, etc. are commonly used in external environment, e.g. in industry. These sphere-, helicoid-, torus-, or ovoid-shaped forms are exposed to electric field effects. High frequency waves that create significant value of the electric field can be the source of the fields above [1, 2]. As for the sphere-shaped dielectric, it is not the dielectric size that determines the value of the field inside the dielectric, but the value of the dielectric constant [3], which implies that the field is the same in both micro and macro spherical shape, provided that the value of the dielectric constant is the same. In all other geometric forms of dielectric, the field within it is correlated with its dimensions.

In this study, the value of the field in an ovoid-shaped dielectric will be determined, whereby the method of fictitious sources [4, 5] is employed to determine the fields and potentials.

2 Dielectric Model and Formulation of the Problem

To ensure the ovoid shape of the dielectric, an approximation of the outer surface of the dielectric was done using the equation in (1).

$$r = a + b \cos \theta, \quad a > b > 0, \quad 0 \leq \theta \leq 2\pi. \quad (1)$$

It is assumed that the form is independent and filled with dielectric $\varepsilon = \varepsilon_0 \varepsilon_r$ and subjected to the effect of the electric field $\vec{E}_0 = E_0 \vec{x}$, where ε_r stands for relative dielectric constant of the dielectric inside the ovoid-shaped form. The electric field and the potential both inside and outside of the ovoid-shaped electrodes cannot be accurately determined therefore the method of fictitious sources will be used for approximate workout of this problem.

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