Lecture 15

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1 Boundary Conditions for Electric Fields

At a boundary, from Faraday's Law,

$$\oint_C \vec{E} \cdot d\vec{l} = 0$$

When we take the limit as the total normal distance goes to 0, for a rectangular box containing the boundary, we see the tangential components of E must be equal across the boundary. Then from Gauss' Law,

$$\oiint_S \vec{D} \cdot d\vec{S} = \rho_s$$

Taking the limit as the normal distance goes to 0,

$$D_{\text{out}} - D_{\text{in}} = \rho_s$$

or in general

$$(\vec{D}_{\text{out}} - \vec{D}_{\text{in}}) \cdot \hat{n} = \rho_s$$