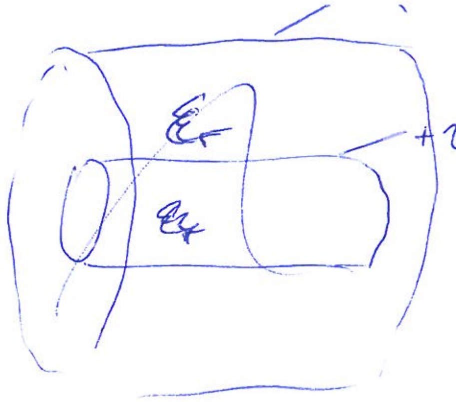

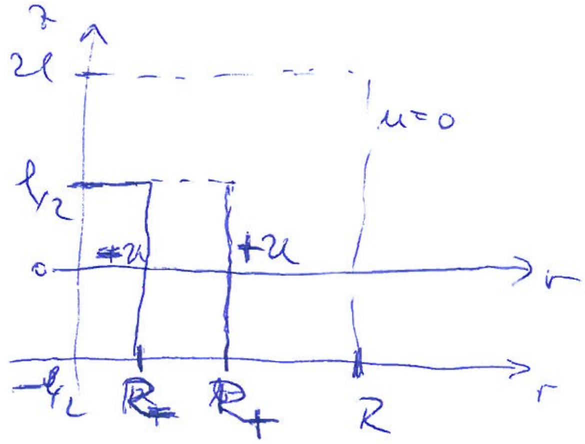

$$\begin{cases} -\operatorname{div}\left[\varepsilon_0 \varepsilon_r(x) \nabla u(x)\right] = 0 & \text{v } \Omega \\ u(x) = +\mathcal{U} & \text{na } \Gamma_+ \\ u(x) = -\mathcal{U} & \text{na } \Gamma_- \\ u(x) = 0 & \text{na } \Gamma \end{cases}$$

$$r = \sqrt{(x_1)^2 + (x_2)^2}$$

$$\frac{\partial r}{\partial x_1} = \frac{x_1}{r}, \quad \frac{\partial r}{\partial x_2} = \frac{x_2}{r}$$

Slabá formulace: ~~$u(x) =$~~

$$x_1 = r \cdot \cos\varphi$$
$$x_2 = r \cdot \sin\varphi$$
$$x_3 = z$$

$$u(x) = \hat{u}(r, z)$$

$$\frac{\partial u}{\partial x_1}(x) = \frac{\partial \hat{u}}{\partial r}(r,z) \cdot \frac{\partial r}{\partial x_1}$$

$$= \frac{\partial \hat{u}}{\partial r}(r,z) \cdot \frac{x_1}{r}$$

$$J = \begin{vmatrix} \cos\varphi & \sin\varphi & 0 \\ -r\sin\varphi & r\cos\varphi & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

$$\det J = r$$

$$\int_\Omega \varepsilon_0 \varepsilon_r(x) \cdot \nabla u(x) \cdot \nabla v(x)$$

$$= \int_0^R r \cdot \int_0^{2\pi} \int_{-L}^{L} \varepsilon_0 \cdot \hat{\varepsilon}_r(r,z) \cdot \begin{pmatrix} \frac{\partial \hat{u}}{\partial r} \cos\varphi \\ \frac{\partial \hat{u}}{\partial r} \sin\varphi \\ \frac{\partial \hat{u}}{\partial z} \end{pmatrix} \cdot \begin{pmatrix} \frac{\partial \hat{v}}{\partial r} \cos\varphi \\ \frac{\partial \hat{v}}{\partial r} \sin\varphi \\ \frac{\partial \hat{v}}{\partial z} \end{pmatrix} dz \, d\varphi \, dr$$

$$\frac{\partial u}{\partial x_2} = \frac{\partial \hat{u}}{\partial r} \cdot \frac{x_2}{r}$$

$$\frac{\partial u}{\partial x_3} = \frac{\partial \hat{u}}{\partial z}$$

$$= \int_0^R r \int_0^{2\pi} \int_{-L}^{L} \varepsilon_0 \cdot \hat{\varepsilon}_r(r,z) \cdot \nabla \hat{u} \cdot \nabla \hat{v}$$