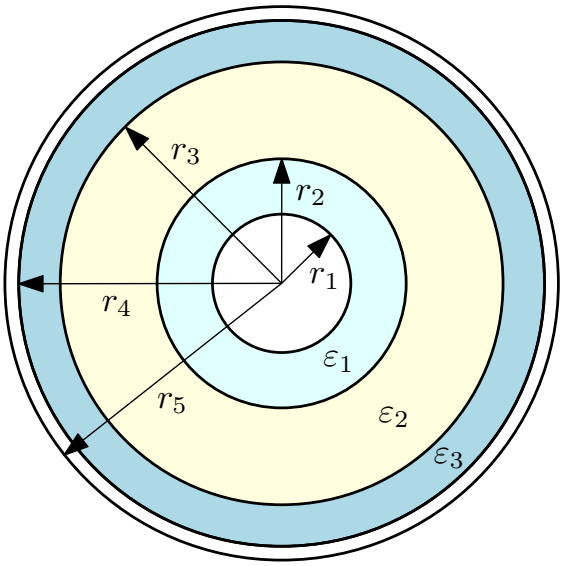
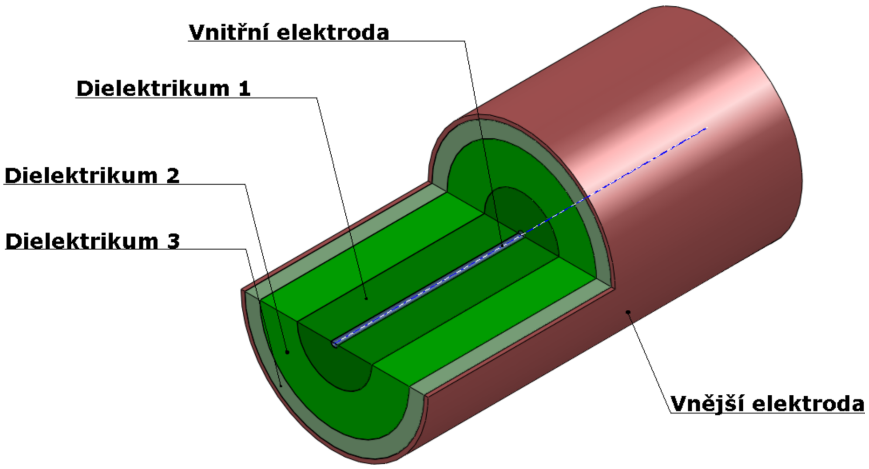
1. Testing work in subject KEP/MMP

Cylindrical capacitor

Create a numerical model of the electric field distribution in a three-layer cylindrical capacitor according to Figure 1 and Figure 2, which respects the edge phenomenon (i.e. the capacitor has an air envelope). All necessary parameters – capacitor dimensions (radii of individual layers r_1, r_2, r_3, r_4 and r_5, radius of the artificial boundary r_0, length of the capacitor l), electrode voltage (inner electrode U, outer electrode 0 V) and material properties $\varepsilon_{r1}, \varepsilon_{r2}$ and ε_{r3} are automatically generated in the frame of the job specification. The center of the coordinate system is identical with the center of the model.



Obrázek 1: Geometry of the solved capacitor



Obrázek 2: Scheme of the solved capacitor

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Determine the

- electric field strength E $(\mathrm{V} \cdot \mathrm{m}^{-1})$ at the specified point $P = [P_\mathrm{r}, P_\mathrm{z}]$ (m),
- total electrode charge Q (pC),
- energy of electric field of the capacitor W_e (nJ) a
- capacity C (pF)

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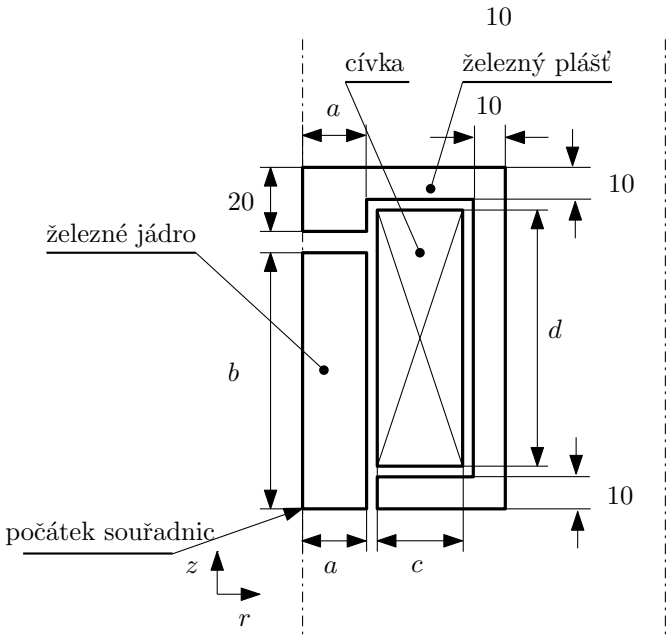
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2. Testing work in subject KEP/MMP

Actuator

Create a computer model of the magnetic field distribution around the actuator shown in Figure 3. All necessary parameters – dimensions a, b of the armature, dimensions c, d of the inductor, number N of turns of the inductor, current I and the relative permeability μ_r of both the core iron and shell are automatically generated in the task assignment. The air gap between the inductor and magnetic circuit is 2 mm. Choose the size of the artificial boundary appropriately. All dimensions are given in millimeters.



Obrázek 3: Geometry of solved actuator

Determine the

- magnetic flux density B (T) at the specified point $P = [P_r, P_z]$ (m),
- power F_z (N) acting on the actuator armature in the axial direction z and
- magnetic field energy W_m (mJ).

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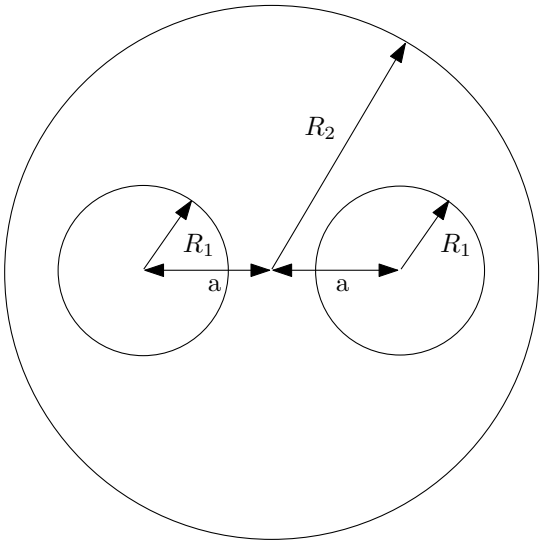
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3. Testing work in subject KEP/MMP

Cable

Create a computer model of the temperature distribution inside the cable shown in Figure 4. All necessary parameters - wire radius R_1, cable insulation radius R_2, distance of wire centers from the center of the cable a, current flowing through conductors I, thermal conductivity of insulation λ and coefficient α of heat transfer at the surface of the cable are automatically generated in the task specification. All dimensions are given in millimeters. First, calculate the bulk density of the heat generated in the conductors by the Joule losses produced by the passing current. The electric conductivity of copper conductors is $5.7 \cdot 10^7$ S$\cdot$ m^{-1}, thermal conductivity of copper is 400 W $\cdot$ m^{-1} $\cdot$ K^{-1}. Consider the specific heat capacity of the insulation 3000 J $\cdot$ kg^{-1} $\cdot$ K^{-1}. The ambient air temperature is 20 °C.



Obrázek 4: Geometry of solved cable

Determine the

- heat density Q (MW/m^3) produced in conductors due to Joule losses caused by the passing current,
- temperature value T_{point} (K) at the specified point $P = [P_x, P_y]$ (mm),
- total heat flux f (W) transferred from one meter of the cable to its surroundings and
- average temperature T_{avg} (K) of the cable.

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