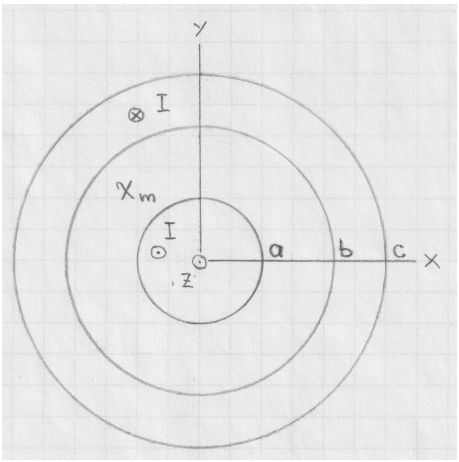
## [lex69] Magnetic material between coaxial cylinders with currents

Consider two long coaxial cylinders with radii $a, b, c$ as shown in cross section. They carry steady currents $I$ with uniform current densities in opposite directions. The space between the conductors is filled with magnetic insulating material characterized by a susceptibility $\chi_{\mathrm{m}}$. Symmetry dictates that the magnetic field only has a $\phi$-component (in cylindrical cordinates) and that its value only depends on $r$.
(a) Use Ampère's law for the **H**-field to calculate $H_\phi(r)$ in the four regimes (i) $0 < r < a$, (ii) $a < r < b$, (iii) $b < r < c$, and (iv) $r > c$.
(b) Show that the bound current density is zero inside the insulating magnetic material: $\mathbf{J}_{\mathrm{b}} = 0$. Determine the bound interface current density $\mathbf{K}_{\mathrm{b}}$ at $r = a$ and at $r = b$.




**Solution:**