Boundary Conditions at Surfaces

We would like to examine how the components of a magnetic field change as it crosses a surface current (with surface current density $\vec{K}$). Use one of the integral forms of Maxwell's equations, either

$$\oint \vec{\boldsymbol{B}} \cdot d\vec{\boldsymbol{r}} = \mu_0 I_{\text{enc}}$$

around a small, rectangular loop or

$$\oint \vec{\boldsymbol{B}} \cdot d\vec{\boldsymbol{A}} = 0$$

over a small box to find the discontinuity in the component of the field assigned to your group. You will have to decide which law to use and how to orient your loop or box depending on the physics of the problem.

If you get done with the first example, go on to another.

Groups numbered $3n$:

Find the discontinuity in the component of the magnetic field parallel to the surface and also parallel to the current, denoted $B_{\parallel\,\parallel}$.

Groups numbered $3n+1$:

Find the discontinuity in the component of the magnetic field parallel to the surface and also perpendicular to the current, denoted $B_{\parallel\,\perp}$.

Groups numbered $3n+2$:

Find the discontinuity in the component of the magnetic field perpendicular to the surface, denoted $B_{\perp}$.

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