

Griffiths Electrodynamics: Problem 5.21

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Part A

Equation 1.46 states the divergence of a curl is always 0,

$$\nabla \cdot (\nabla \times \mathbf{v}) = 0.$$

When we apply this to Ampere's law,

$$\begin{aligned}\nabla \times \mathbf{B} &= \mu_0 \mathbf{J} \\ \nabla \cdot (\nabla \times \mathbf{B}) &= \mu_0 \nabla \cdot \mathbf{J} \\ &= \mu_0 \frac{d\rho}{dt}.\end{aligned}$$

But, $\mu_0 \frac{d\rho}{dt}$ is only zero if there is not charge moving, aka magnetostatics!

Part B

Looking at the other Maxwell's equations, the only other one with a curl is $\nabla \times \mathbf{E} = 0$, and the divergence of both sides is 0. Thus, there are no other "defects."