In Phys 3310 (and again at the start of this term) we learned a boundary condition on E: the parallel component of E is always continuous across any boundary. But that was derived from the electrostatics law that curl(E)=0. Now we know that law is not always true, since curl(E) = -dB/dt (Faraday's law). What does the addition of -dB/dt on the right side do to that boundary condition? [Select ALL that apply]

No impact, the boundary condition STILL holds, the parallel component of E is still continuous across boundaries, even if dB/dt is nonzero

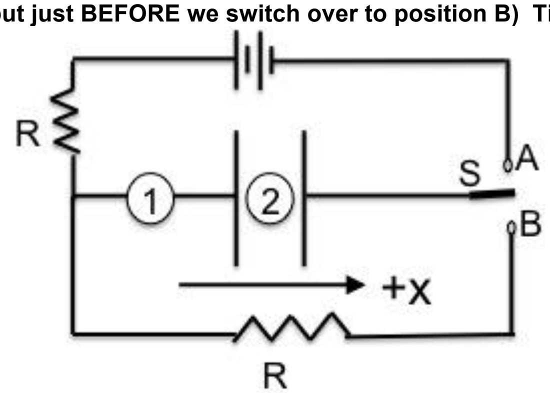
It modifies the boundary condition: now the parallel component of E can "jump" at a boundary, but only if the parallel component of B jumps too

It modifies the boundary condition: now the parallel component of E will "jump" at a boundary in any situation where dB/dt is nonzero

There is no longer any useful boundary condition on the parallel component of E fields in situations where dB/dt is nonzero.

Optional: Use the space below if you want to elaborate on your answer above.

A parallel capacitor (uncharged) is connected in the circuit by a double throw switch S as shown in the picture. At t=0, switch S is thrown to point A and stays for a VERY long time T. At t=T, switch S is thrown to point B. Time1 (t=0+ε): Shortly after S is thrown to point A Time2 (t=T-ε): A VERY long time after S was thrown to point A (but just BEFORE we switch over to position B) Time3 (t=T+ε):



Shortly after S is thrown to point B Indicate in the table below if $(\nabla X B)_x$ is positive (+), negative (-) or (approximately) 0 for these 3 different moments at these two points. (Coordinate defined in the picture)

Point 1, Time 1 (t=0+ε) (+/-/0)
Point 1, Time 2 (t=T-ε) (+/-/0)
Point 1, Time 3 (t=T+ε) (+/-/0)
Point 2, Time 1 (t=0+ε) (+/-/0)
Point 2, Time 2 (t=T-ε) (+/-/0)
Point 2, Time 3 (t=T+ε) (+/-/0)

Please elaborate:…

The continuity equation for current has the form div(J) = -d(rho)/dt. Explain briefly what that minus sign tells us?

Consider, in the abstract, a closed surface integral of the flux of some vector field S. Mathematically, this would look like a double integral (with a little "circle" on the double integral signs) of S dotted with dA.
If that integral comes out NEGATIVE, what is it telling you about the vector field?

That S points INWARDS at all points on the surface

That S points OUTWARDS at all points on the surface

That S might be inwards here and outwards there, but overall there is a net INWARD flow of S.

That S might be inwards here and outwards there, but overall there is a net OUTWARD flow of S.

None of the above, the sign of the integral doesn't directly tell you anything unambiguous about inward or outward flow.

OPTIONAL: If you want to elaborate on the previous question, use the space below.