Consider a rectangular loop of finite resistance oriented as shown in the illustration below. Also assume a uniform **B** field surrounding the bottom side of length L of the loop but not the top. B is perpendicular to the bottom side of the loop.

Now, impart a velocity **v** to the coil along the normal to the loop and the B field. There will be an emf generated along the bottom side **B**L**v** of the loop but none in the other three.

What is the emf of the bottom side? Note that $\partial \mathbf{B}/\partial t = \partial \varphi/\partial t = 0$ everywhere inside the loop as it moves with velocity **v**.

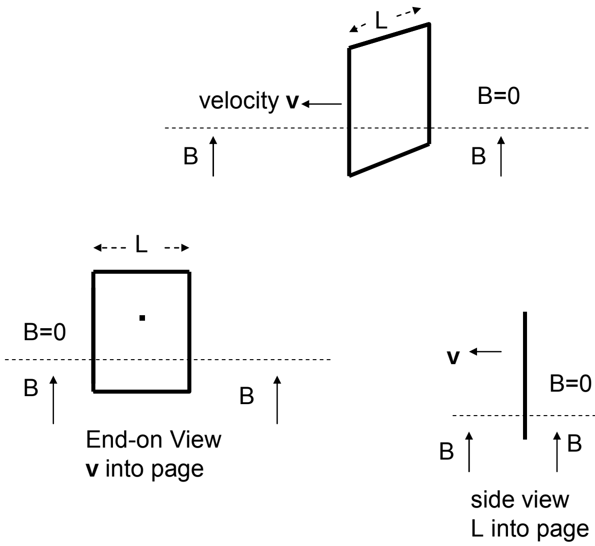
So Faraday's law is inapplicable and Maxwell's equations do not cover this situation unless **del** x **E = -**∂**B /** ∂t is modified.

And the answer is that a term **del** x (**v** x **B**) must be added to the right-hand side, yielding **del** x **E** = -∂**B**/∂t + **del** x (**v** x **B**) or emf = BLv when **E** is integrated over L. This second term is based on the Lorentz magnetic force q**v** x **B** and is not related to Maxwell's equations for stationary media, including Faraday's law, in classical physics.

Note that the BLv law works fine for this situation while Faraday's law does not.

See illustration next page.

Example where Faraday's law fails and Lorentz's law holds
(Blv Law)



Top of loop is in B=0,
Bottom in uniform
B field.
There is no change in flux as loop moves in B field.

emf = Blv.