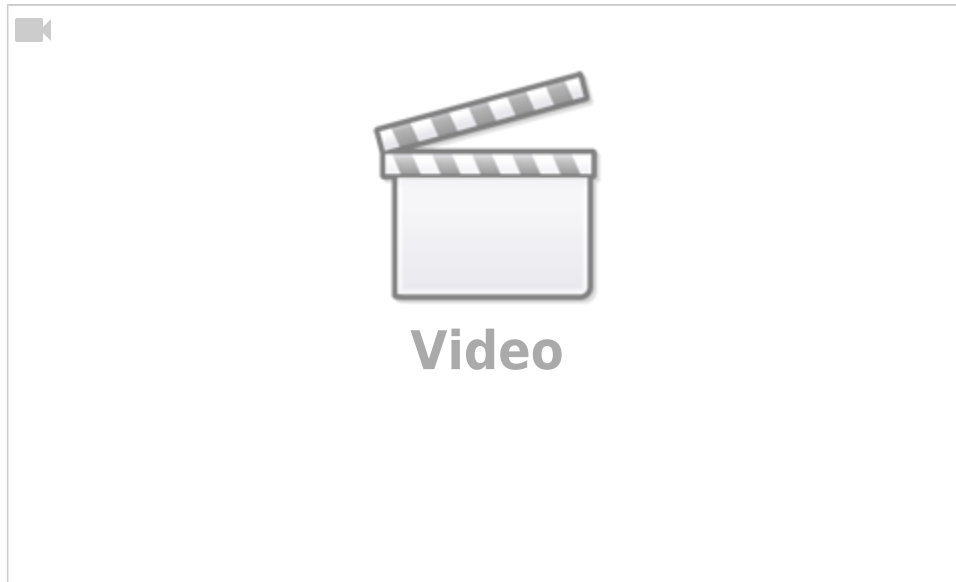


Conceptual Electronics Videos

I just found a series of videos that animate various physics concepts. The first one I found was on the concept of impedance:



But this was #15 in a [series of 24 videos](#). I just finished watching the first few and they basically managed to start from scratch and work their way up to Electro-Magnetism pretty much without math. One thing they could have improved though is the labelling. So while you watch these, keep in mind that:

- Red particles are **positive** charges
- Blue particles are **negative** charges
- Purple arrows are **electric** fields
- Green arrows are **magnetic** fields.

Also, this first video can seem pretty overwhelming, with all these fields creating each other, but there's really only four rules:

Name	Math	Description
Gauss' Law	$\vec{\nabla} \cdot \vec{E} = \frac{\rho}{\epsilon_0}$	An electric charge (right) creates an electric field that points away from the charge and “disperses” to infinity (left)
Gauss' Law of Magnetism	$\vec{\nabla} \cdot \vec{B} = 0$	A magnetic field (left) can not “disperse” to infinity the way an electric field can. In other words: “magnetic charges” don't exist the way electric charges do.
Faraday's Law of Induction	$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$	A changing magnetic field (right) creates a “curly” electric field (left) and vice-versa.
Ampere's Law	$\vec{\nabla} \times \vec{B} = \mu_0 \left(\vec{J} + \epsilon_0 \frac{\partial \vec{E}}{\partial t} \right)$	An electric current and/or a changing electric field (right) creates a “curly” magnetic field (left)

Together, these four equations (known as [Maxwell's Equations](#)) account for all the electromagnetic phenomena we observe:

