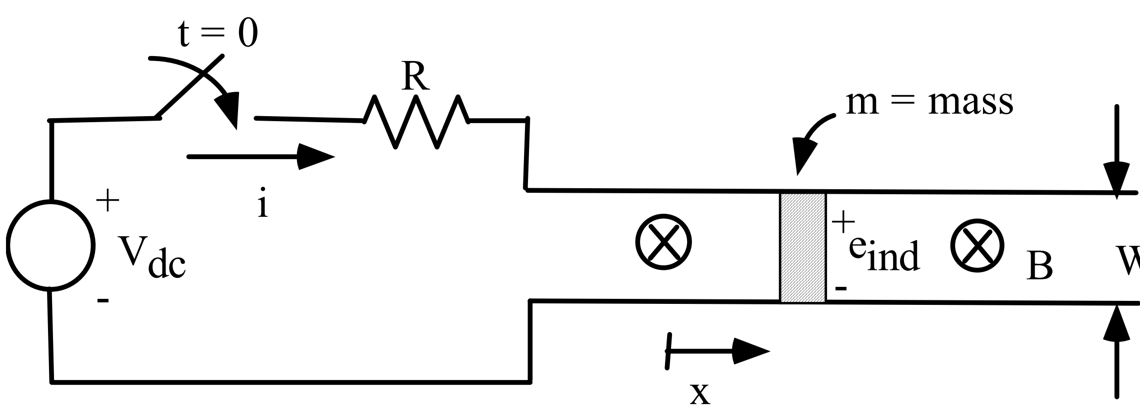
ECE 320: Lecture 22

Notes

Exam 1: Average: 86%

Distribution: A: 90-100: 12
B: 80-89: 14
C: 70-79: 4
D: 60-69: 2
F: < 60: 0

Example:



Now put in some numbers and plot the waveforms:

Vdc := 100V   m := 1kg

R := 5ohm   B := 2T

W := 1ft

$$\tau := \frac{m \cdot R}{W^2 \cdot B^2} \qquad \tau = 13.45\,s$$

t := 0sec, 0.5sec .. 50sec

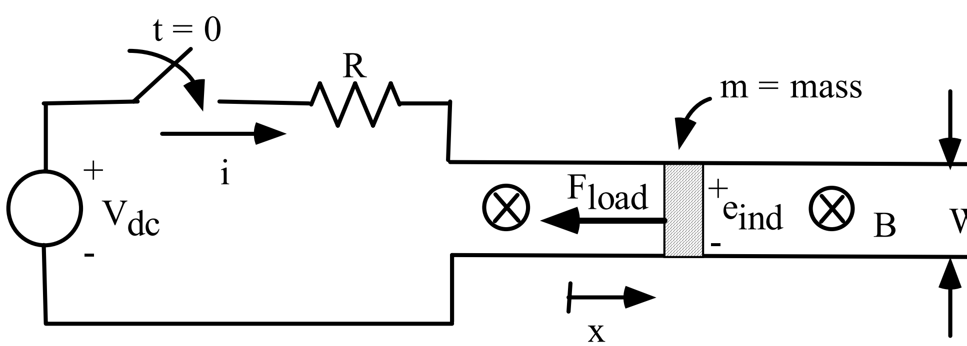
$$i(t) := \frac{Vdc}{R} \cdot e^{\frac{-t}{\tau}} \qquad eind(t) := Vdc - Vdc \cdot e^{\frac{-t}{\tau}}$$

$$f(t) := B\cdot W\cdot \frac{Vdc}{R}\cdot e^{\frac{-t}{\tau}} \qquad vel(t) := \frac{Vdc\cdot\left(1 - e^{\frac{-t}{\tau}}\right)}{W\cdot B}$$

- Note that the above cases are all "unloaded." There is no external force trying to slow the bar down or trying to pull it along. That is why the current and force go to zero once the bar has reached a steady-state velocity.
- In reality, there will always be external forces. We can divide these into 2 additional cases.

Motor Case

Apply a force in the opposition to the direction that the far is moving, called F_{load} on the figure.



Let $Fload := 3N$ Note that $Fmax := B\cdot W\cdot \frac{Vdc}{R}$ $Fmax = 12.19\,N$

Note that is Fmax < Fload it will never start...

Then in steady-state, we need to have force produced electric circuit offset this

$Iss := \frac{Fload}{B\cdot W}$ $Iss = 4.92\,A$

Then: $Ess := Vdc - R\cdot Iss$ $Ess = 75.39\,V$

$vel\_ss := \frac{Ess}{W\cdot B}$ $vel\_ss = 123.68\,\frac{m}{s}$ No load velocity was:

$$\frac{Vdc}{W\cdot B} = 164.04\,\frac{m}{s}$$