# Lecture #3 10/4/2021

Logistics:

→ HW 1 posted, due next Monday Oct 11th 11:59pm PT.

→ Please install PLECS.

Last time

→ Finished Ch 1

→ Started Ch 2 → read this week

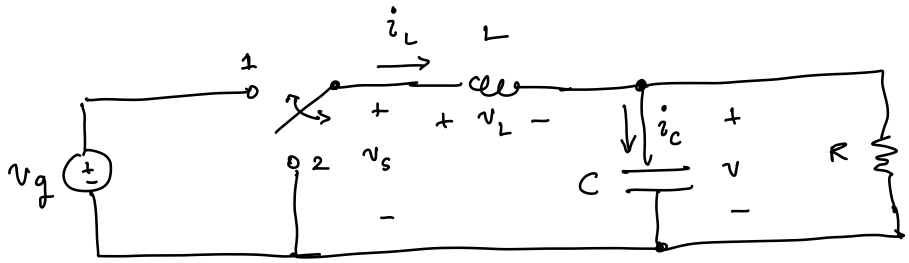
Today

→ Motor modeling handout

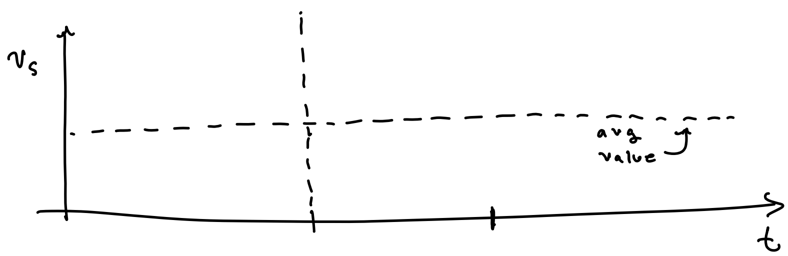
# Chapter 2 → Steady-state Analysis

periodic steady state due to switching

Consider the "Buck" converter
step-down




A comment on polarity / sign conventions for analysis

Avg value = dc component

$\langle v_s \rangle =$

$=$

$=$

$=$

$=$

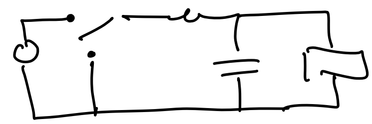
Q: What about the output voltage?

A: LC is a lowpass filter. Dc component appears @ output.

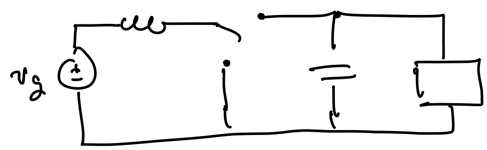
* Need a more generalized method to derive $\frac{v}{v_g} = M$ for <u>any</u> converter

Overview of 3 common converters

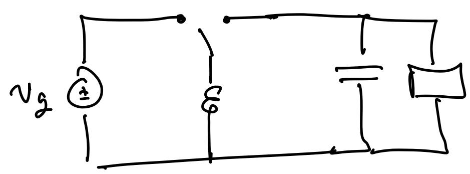
Buck :



Boost :




Buck Boost :




General method to derive $M$ hinges on

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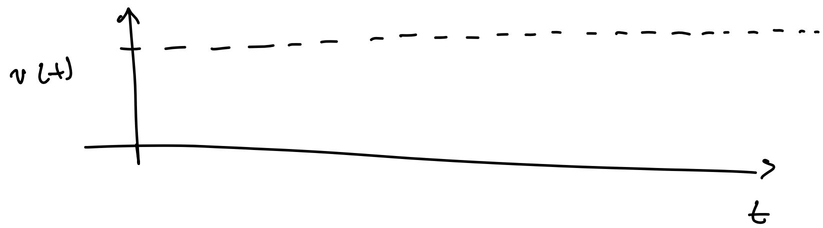
- Buck converter waveforms




$v(t) =$

In most designs $\| v_{ripple} \| < V$

and $v(t) \approx V$

- General Method to Derive S.S. Input-Output Relations

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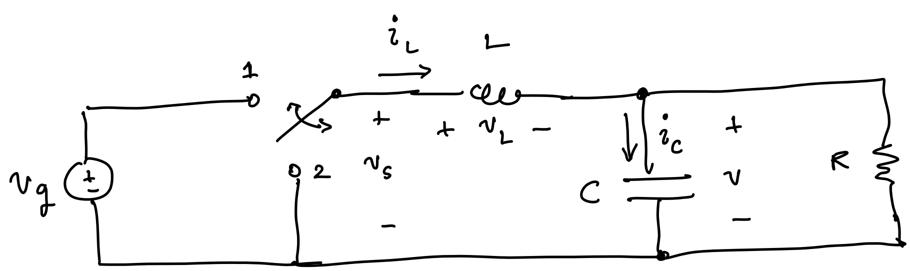
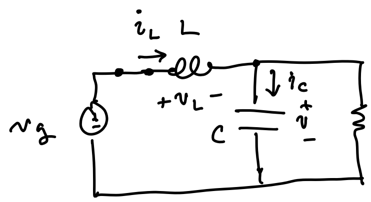


config ①




• Look @ L voltage

$v_L =$ (1)

b/c small ripple @ output

Hence, (1) becomes

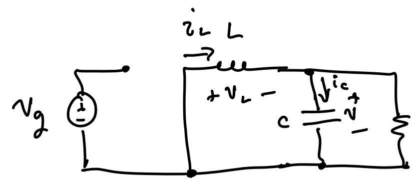
$v_L =$ (2a)

$L \frac{di_L}{dt} =$ (3a)

$=$

$\Rightarrow i_{L_{\text{slope}}} = \frac{di_L}{dt} =$

config ②




• Inductor voltage

$v_L =$

" small ripple ...

$v_L =$ (2b)

$L \frac{di_L}{dt} =$ (3b)

$=$

$\frac{di_L}{dt} =$

Look @ L waveforms