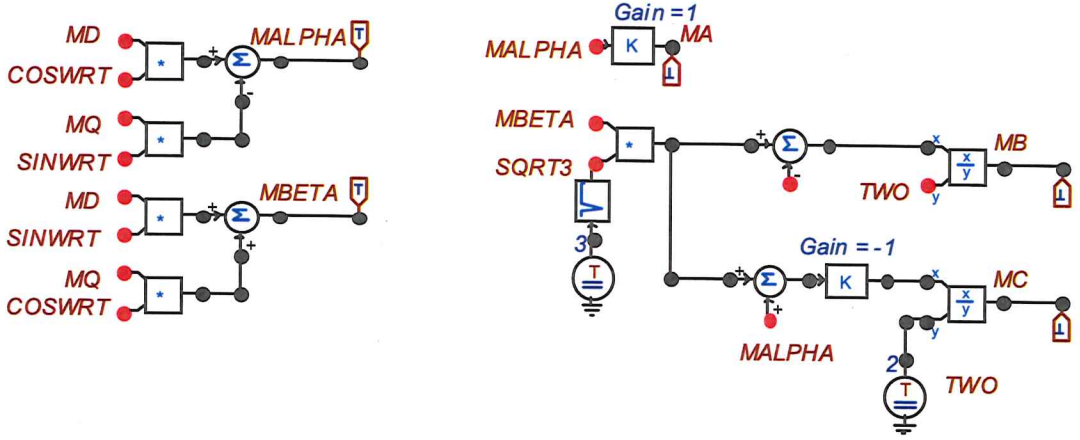
# ECE 404-TD / 504-TD

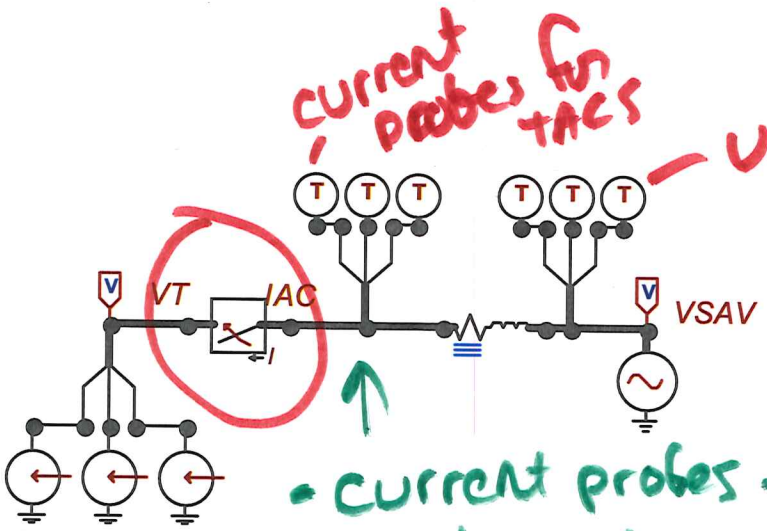
# ST: T&D APPLICATIONS OF VOLTAGE SOURCE CONVERTERS

## SESSION no. 36

- HW due date (HW5)
  → Lecture 39, April 22

## Convert MD and MQ alpha-beta and then to ABC domain




current probes for TACS — voltage problem ($V_{leg}$)

- current probes - connected to node with switch
- TACS interprets current as coming from node into switch regardless of network polarity

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Problem 1 on homework

- with open loop control and P, Q calculated neglecting Resistance

→ The calculated $|V_t| \angle \delta$ will not give precise match of P, Q in ATP or EMTDC

$K_p \rightarrow$ Proportional gain

$K_i$ - integral gain

If $i_d$, $i_q$ are constant in steady state

$$\frac{K_i}{K_p} = \frac{R_s}{L_s}$$


$$\frac{K_p}{L_s} = \frac{1}{\tau_i}$$

$\tau_i$ → Time constant of desired response → Book uses 5ms

If in synch ref frame → change

$\omega_0 L$ in cross coupling term in control loop

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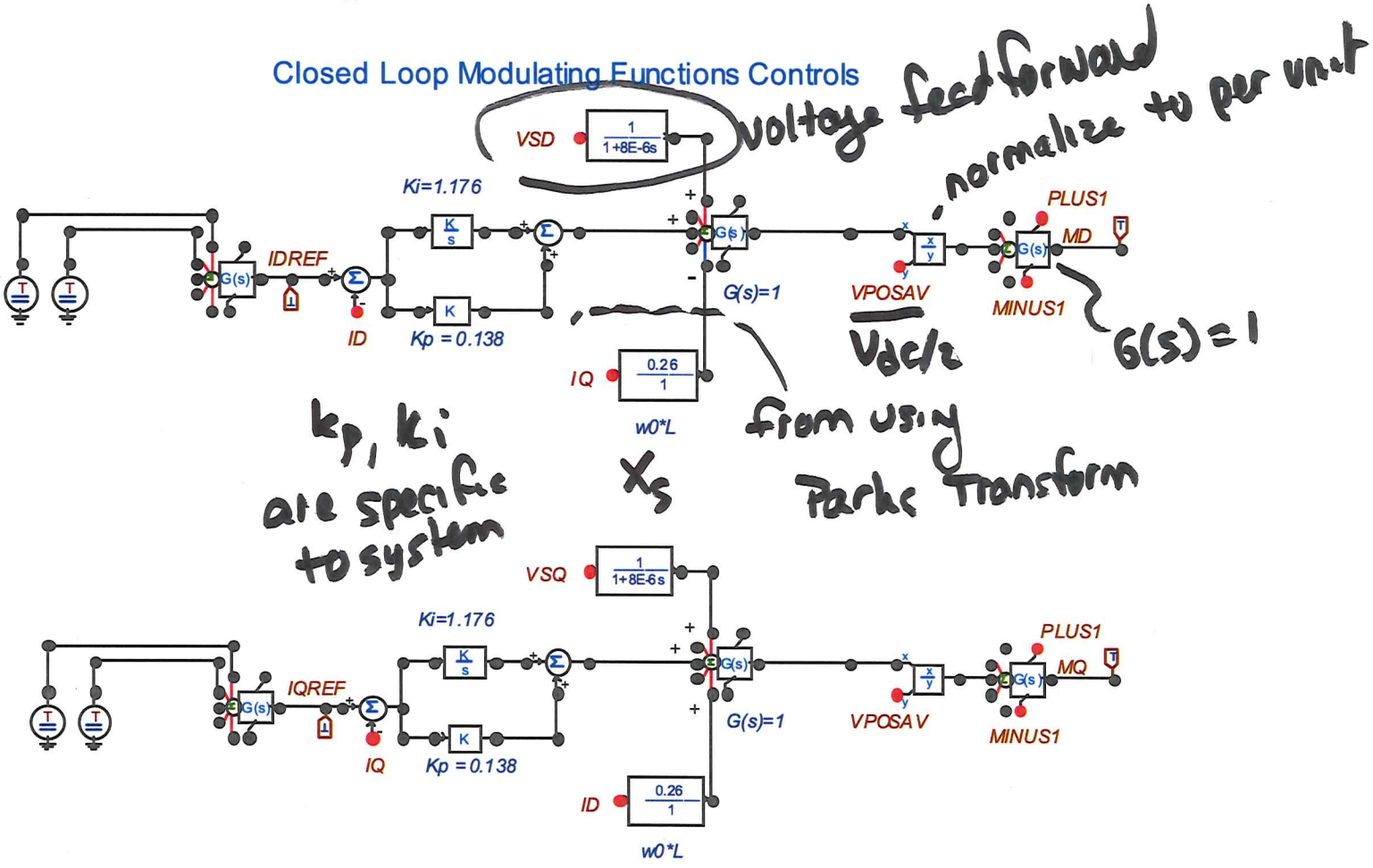
# Closed Loop Controls

## Closed Loop Modulating Functions Controls




Voltage feedforward, normalize to per unit

kp, ki are specific to system

Xs

from using Park Transform

Vdc/2

G(s)=1

## Convert MD and MQ alpha-beta and then to ABC domain

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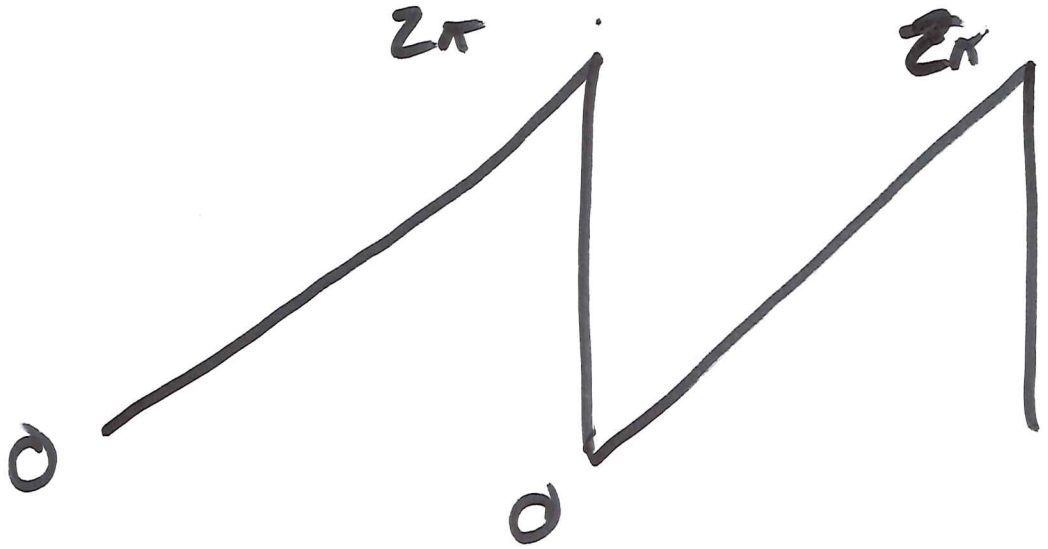
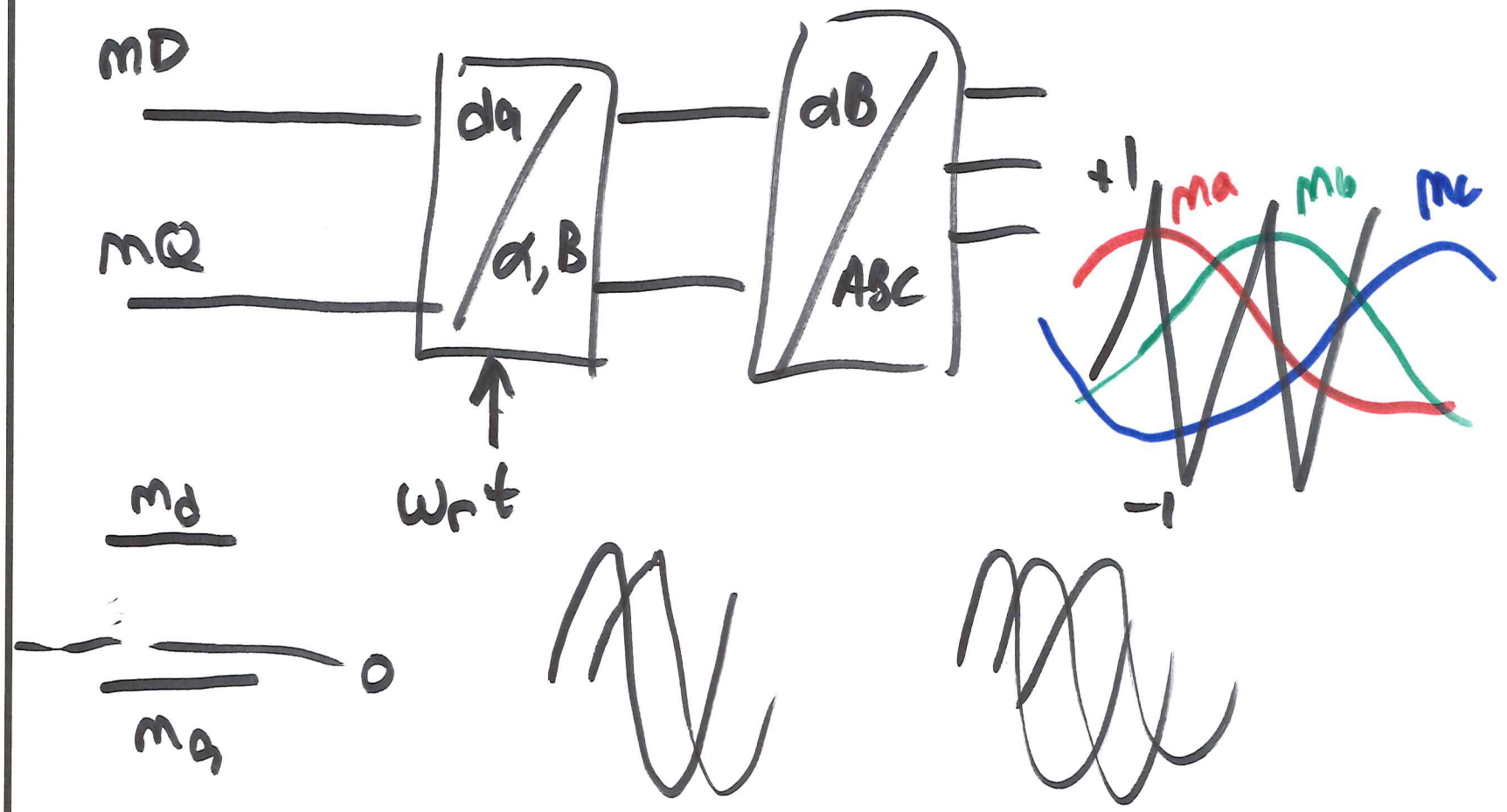
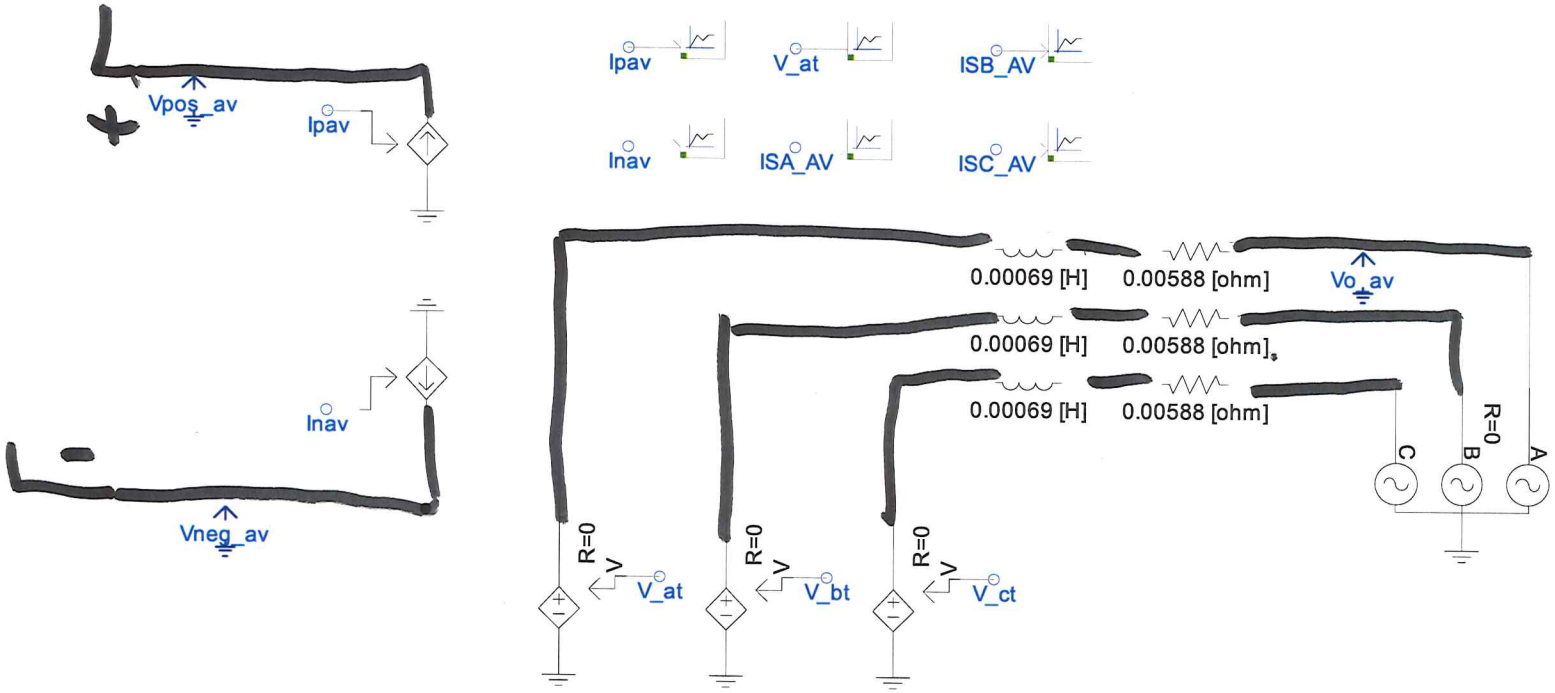



mD
mQ
dq
α,B
aB
ABC
ωrt
+1
-1
ma
mb
mc
md
mq
0

- Averaged Model Power Circuit (note DC links tied to switching model to reduce node count)



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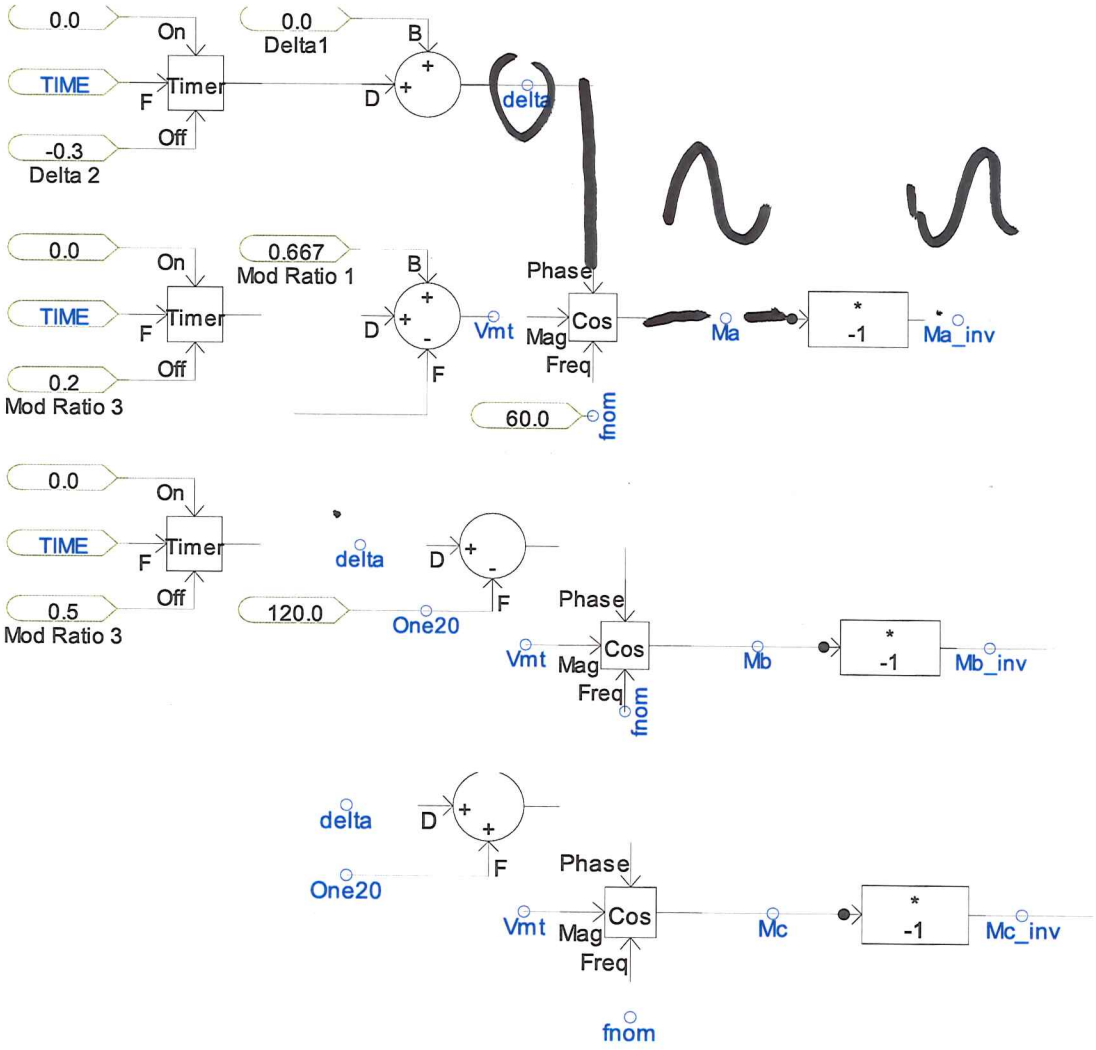
- Create Open-loop Modulating Functions



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# PSCAD/EMTDC Implementation of Three Phase Averaged Models

- Switching circuit