

Topics for Today:

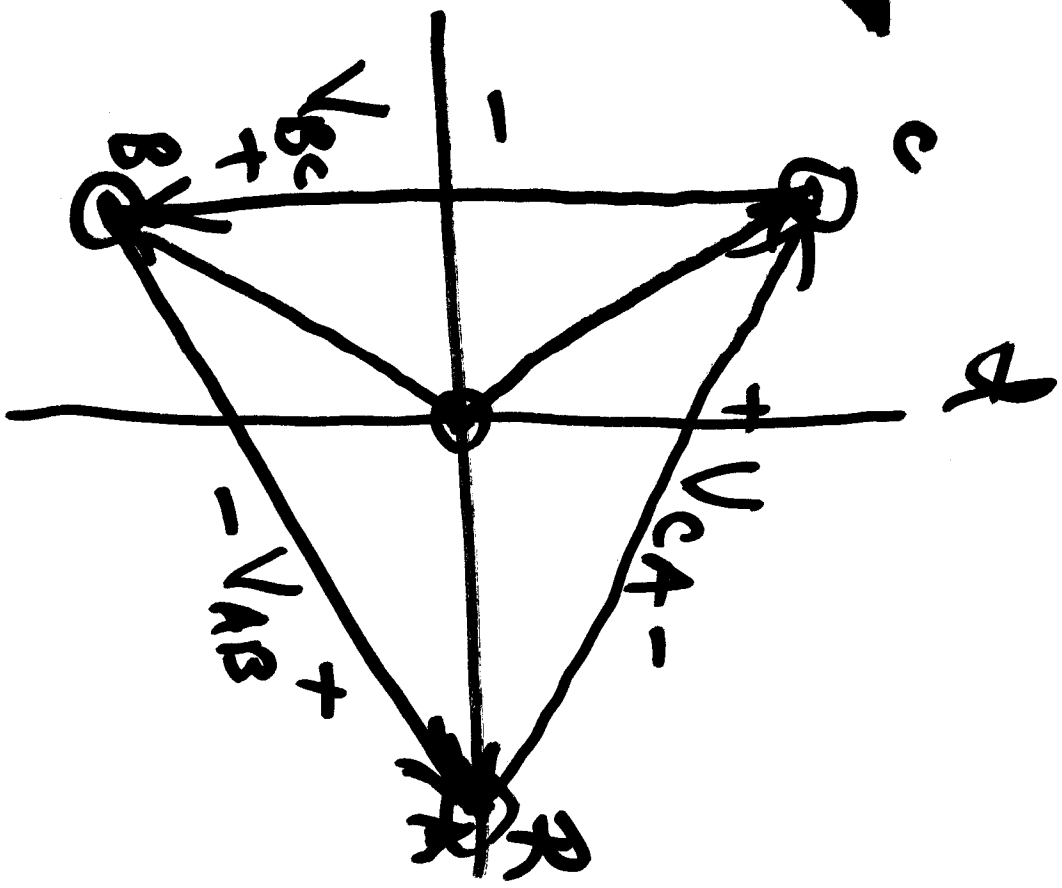
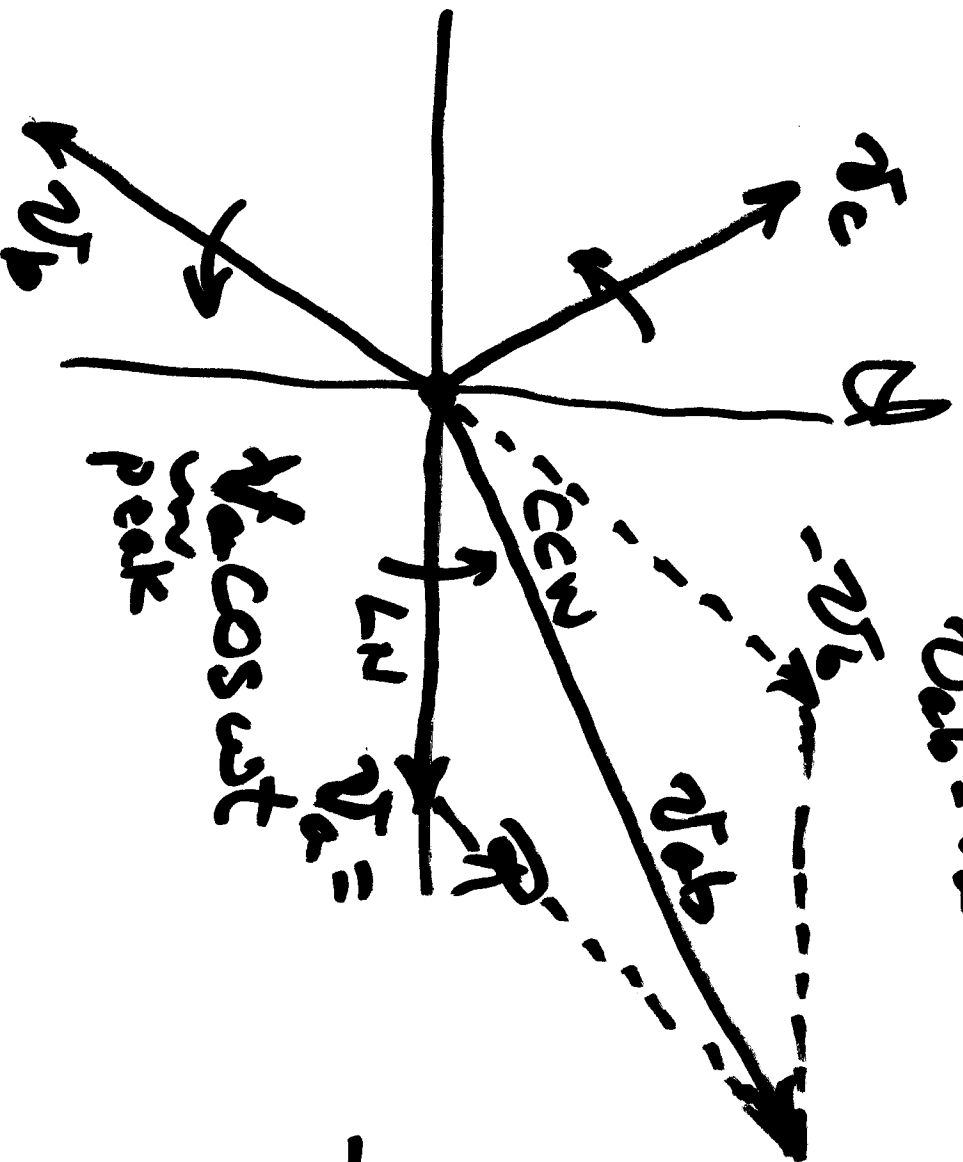
- Announcements
 - EE5200-L@mtu.edu now working. Use it.
 - Bring calculator to lectures, for in-class sample calculations.
 - Buy a 2" 3-ring binder for course materials.
 - Room B45 is open from 9am onward.
 - Office hrs: 1:30-2:30pm, Mon, Wed, Fri
 - Office: EERC 623. Phone: 906.487.2857
 - Ch.1 Solutions posted on web page. Finish by Sept. 5th.
 - Set of pre-req / review exercises given out next week.
- Continuing with Chapter 1 / Review:
 - Ideal transformer: V, I, S, P, Q relationships
 - Nodal Analysis: Forming node equations [Y] [Z], [I], [V]
 - Matrix description of system, physical meaning.
 - Three-phase analysis, per-phase (L-N phase-A) equivalent.
 - Per Unit system
 - Symm Comp.

EE 5200 Class Roster - Fall 2003

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Phasor Diagrams

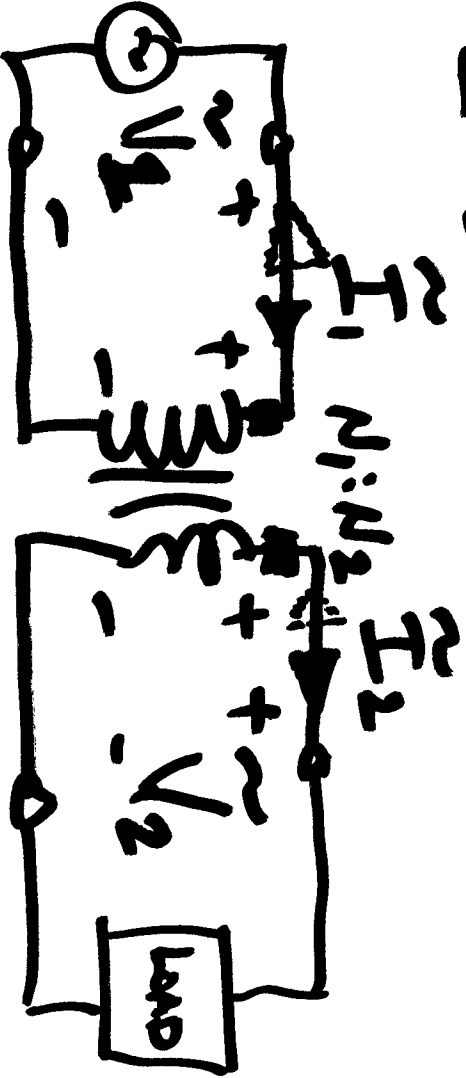
$$V_{cb} = V_c - V_b$$



Time Domain

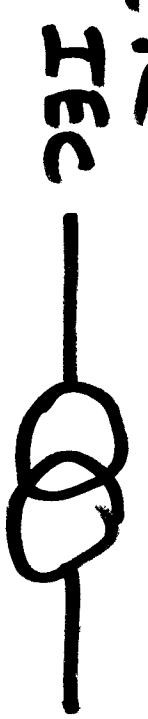
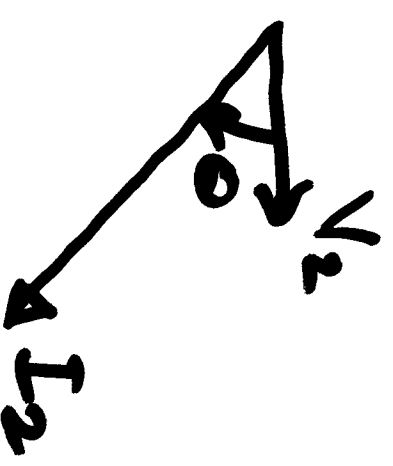
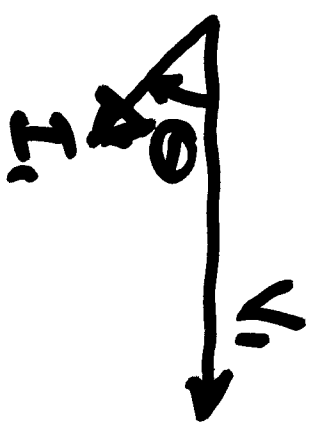
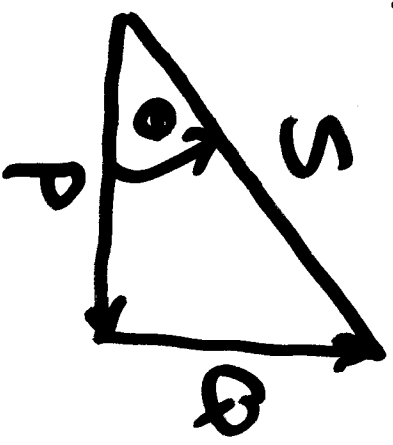
Phasor Domain

IDEAL TRANSFORMER

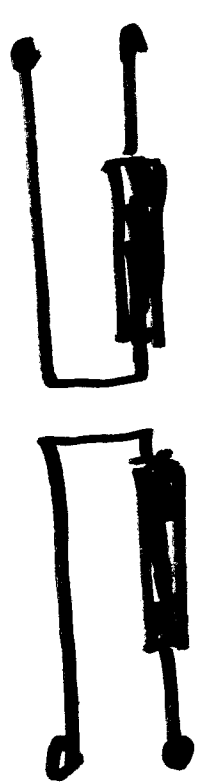


$$V_{A_{in}} = V_{A_{out}}$$

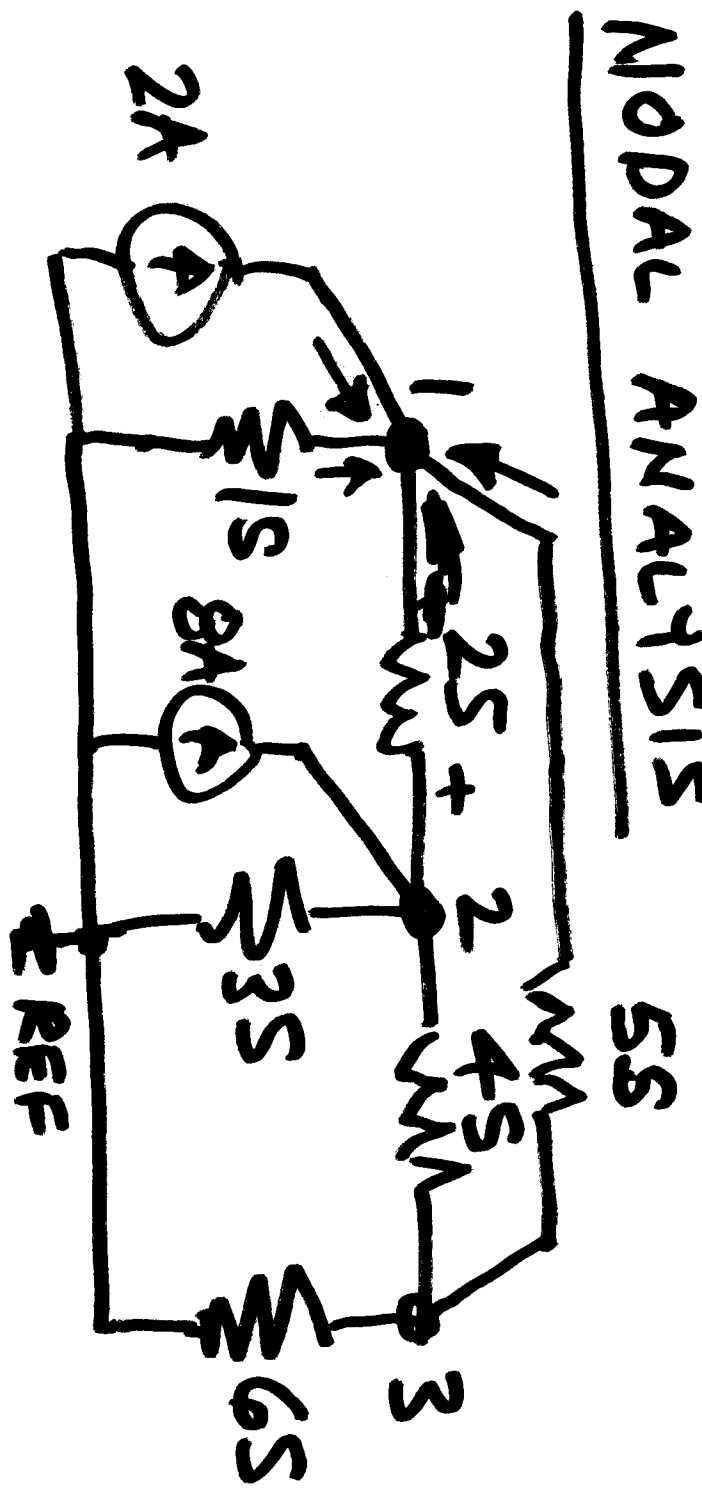
$$S_1 = V_1 I_1 = V_2 I_2 = S_2$$



4



NODAL ANALYSIS



$$G = \frac{1}{R}$$

$$S = \frac{1}{X}$$

$$Y = \frac{1}{Z}$$

KCL: $2 + (v_2 - v_1)2 + (v_3 - v_1)5 + (-v_1)1 = 0$

② $8 + (v_1 - v_2)2 + (v_3 - v_2)4 + (-v_2)3 = 0$

③ $0 + (v_2 - v_3)4 + (v_1 - v_3)5 + (-v_3)6 = 0$

each y :

$$y = g + j\omega b$$

$$\Rightarrow [Y][V] = [I_{ins}]$$



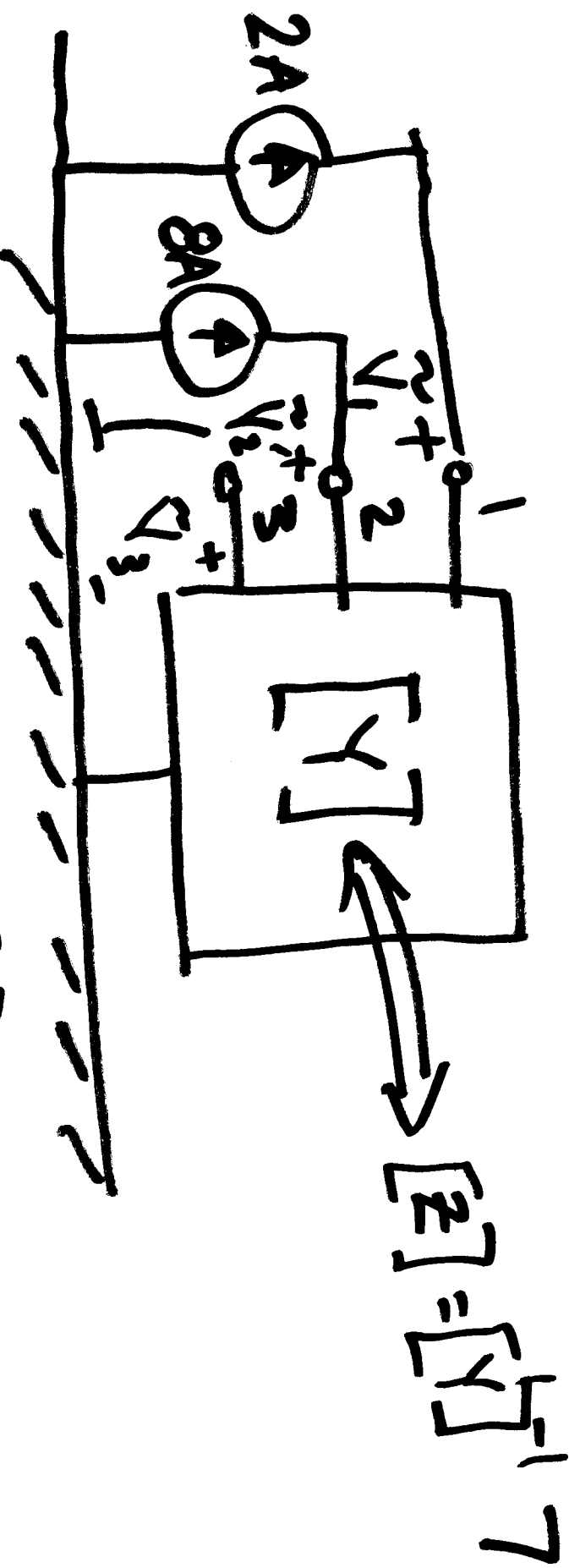
$$\begin{bmatrix} 2+5+1 & -2 & -5 \\ -2 & 2+4+3 & -4 \\ -5 & -4 & 4+5+6 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} = \begin{bmatrix} +2 \\ +8 \\ 0 \end{bmatrix} \quad 6$$

[Y] is symmetric about main diagonal
 (unless we have phase-shifting xfrms
 or FACTS devices in system).

Notes: Rules

$$\begin{bmatrix} y_{11} & y_{12} & y_{13} \\ y_{21} & y_{22} & y_{23} \\ y_{31} & y_{32} & y_{33} \end{bmatrix} \leq$$

- 1) Off-diagonal admittances are: $y_{nk} = -\sum$ of "spanning" branches.
- 2) Main-diagonal admittances $y_{kk} = +\sum$ of the connected admittances.



Why use $[Y]$ instead of $[Z]$?

ie. why use nodal analysis and admittances?

$[Y]$ is very sparse!

$[Y]^{-1} = [Z]$ is a full matrix.

Correct terminology!

~~Y-Bus~~ "Y-Bus" $[Y]$: Nodal Admittance Matrix
 "Z-Bus" $[Z]$: Impedance Matrix