EE 5240 - Lecture 6 Friday Jan 25, 2019

Topics for Today:

- Questions from last lectures?
  - Kron Reduction for non-bilateral network
    - http://www.ece.mtu.edu/faculty/bamork/ee5200/5200_L27.pdf
- Comments on Homework #2
  - Augmentation for L-G Fault - signs !

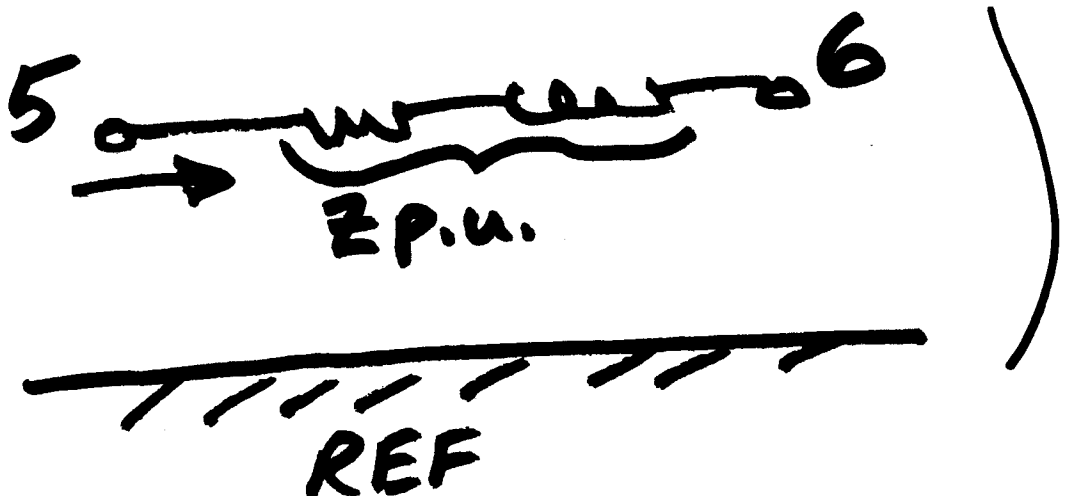
Today - system data for computer studies

- Using $[Y_{BUS}]$ to calculate fault-current contributions
- Transformer Data
- More on tap-changing transformers

Coming up - keep studying Chapters 3 & 4.

- Nonlinear systems of equations
- Newton Iterative Method
- Newton-Raphson Load Flow Formulation
- Everybody have access to Aspen?

XFMRS - Use L-N (ϕA-N) Per Phase Equiv.



Modify
y_{55}^- y_{56}^-
y_{65}^- y_{66}^-

In [Ybus]

$$y_{56} = -\frac{1}{Z_{56}}$$

(and y_{65})

$y_{55} = y_{55}^- + \frac{1}{Z_{56}}$

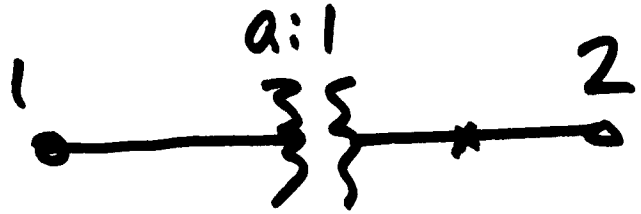
$y_{66} = y_{66} + $ "

Basis 2-winding XFMR is simple.

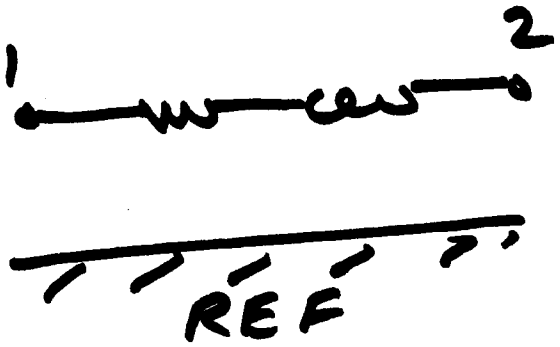
How about?
- LTC (or TCUL)
- Phase Shifter (PS)

Basic Approach: Develop π-Equiv and handle just like T-Line.

One-Line:

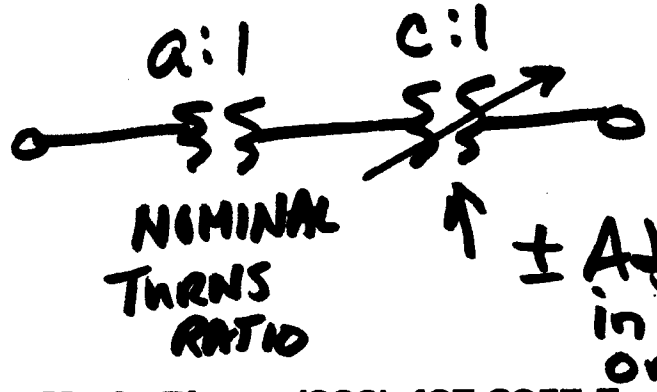


per-unit per-phase



Tap-Changers

- LTC's
- Phase-Shift



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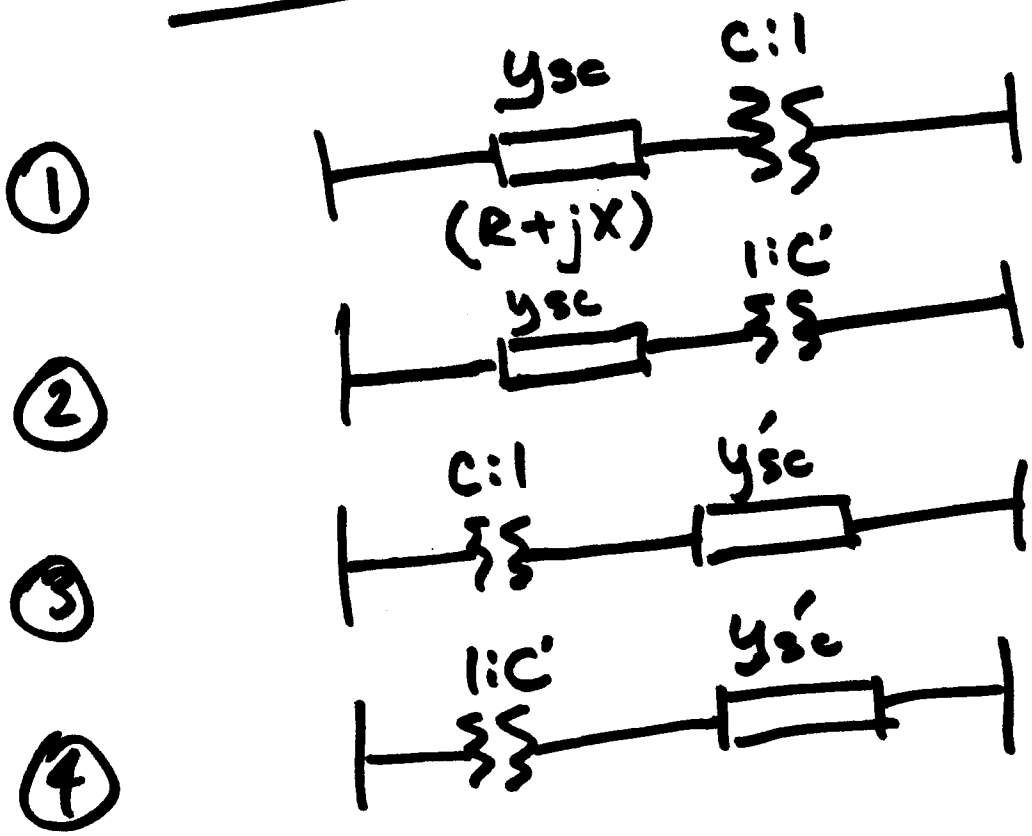
Tap Changing XFMRS - Variations (p.u. representations)

"From" Bus

"To" Bus



$$y_{sc} = \frac{1}{R+jX}$$

"c" is off-nominal turns ratio. In general c is complex.

c is real for LTC.

c is complex for PS.

If $|c| \neq 1$ then magnitude change.

If c is complex, Phase shift.

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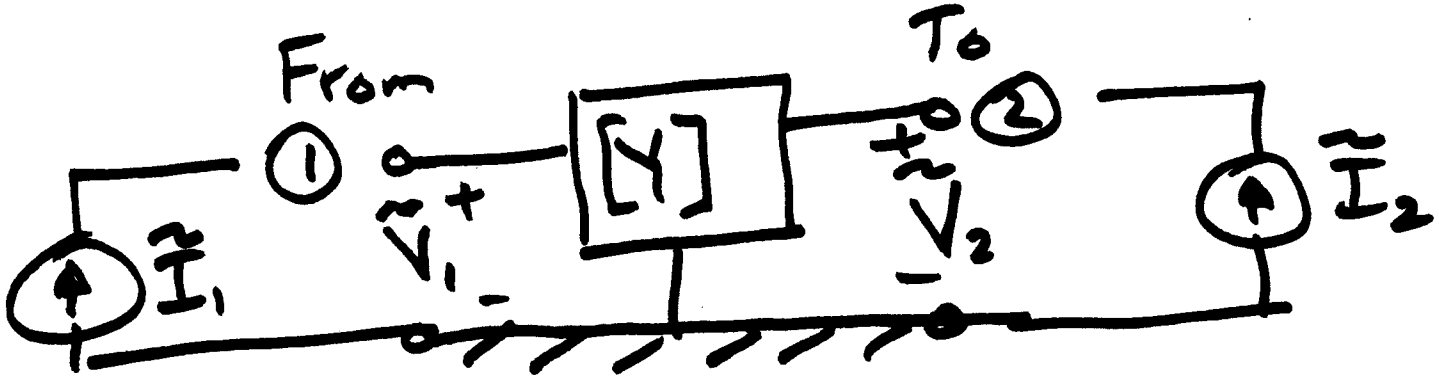
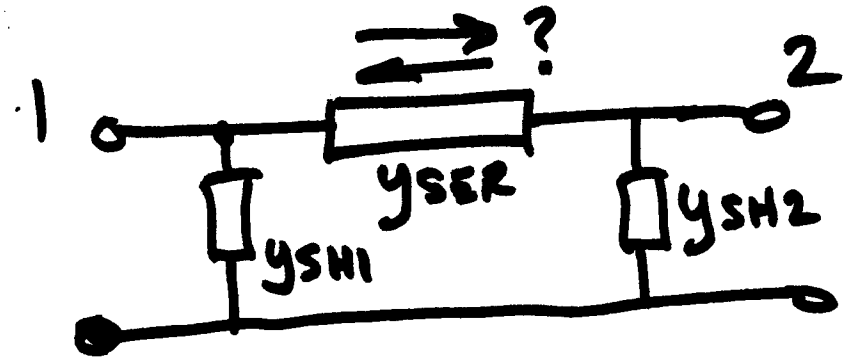
Standard Approach:



$$\begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

Goal:



$y_{11} = \overrightarrow{y_{SER}} + y_{SH1}$

$y_{12} = -\overrightarrow{y_{SER}}$

$y_{21} = -\overleftarrow{y_{SER}}$

$y_{22} = \overleftarrow{y_{SER}} + y_{SH2}$

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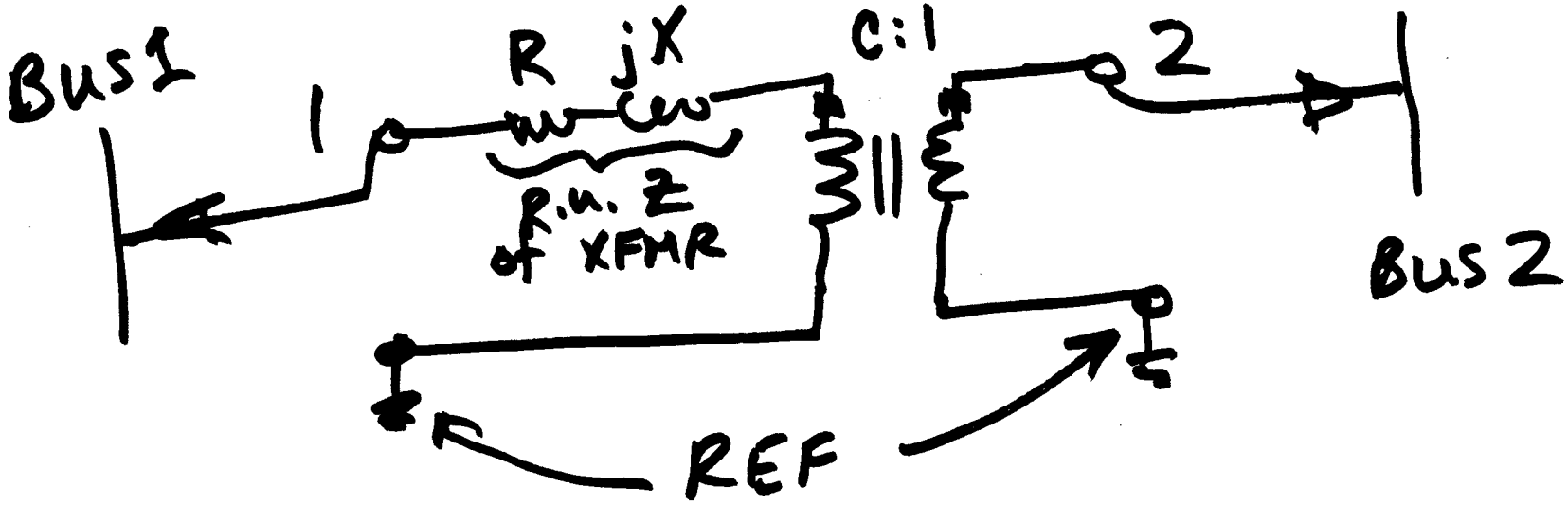

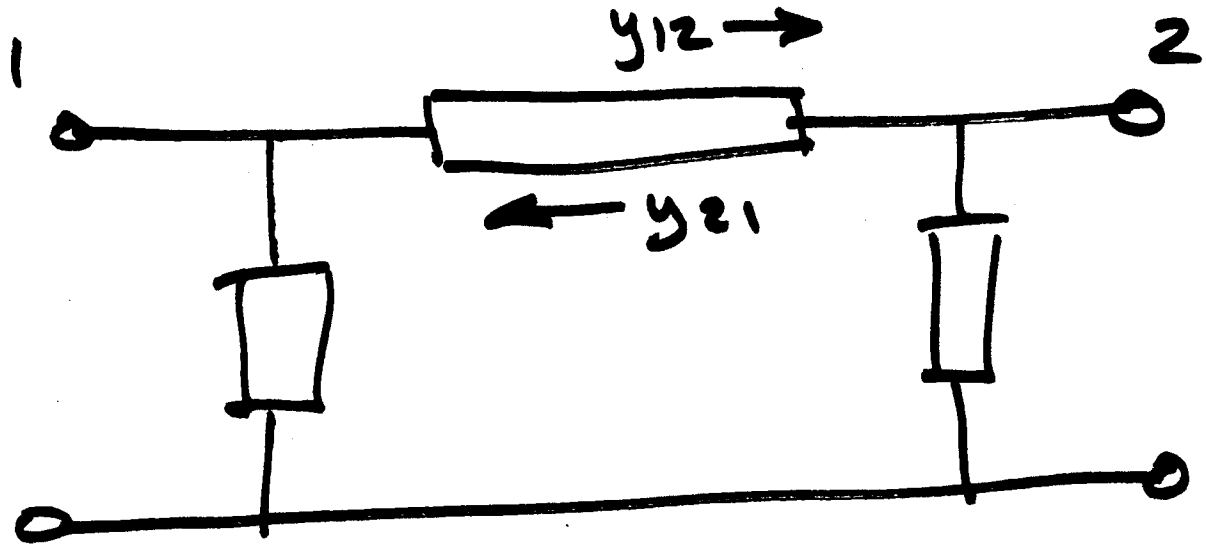

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