Topics for Today:

• Announcements
  • Help session hrs: TBA
  • Office: EERC 614. Phone: 906.487.2857
  • Recommended problems from Ch.3, solutions posted

• Transformers and circuits w/transformers
  • Paralleling of transformers
    • Proportioning of MVA flow for unequal MVA size, unlike impedances
    • Circuit calculations for above cases
    • Design and operations issues
  • Phase shifting transformers
  • Admittance matrix methods to simplify transformer calculations.
• Remaining topics will be covered again in context of system operation & analysis, i.e. Chapters 7 and 8. We can introduce main concepts here:
  • Per phase Pi-equivalent for off-nominal turns ratio, phase shifts, etc.
  • Incorporation in system admittance matrix for short-circuit and load flow
Synchronous Machines - Chapter 3

- Recommended problems & solns for Ch.3 are posted.
- Phasor diagrams - unity, lag, lead
- Salient rotor machines - calculation with Xd and Xq.
- Calculation Example(s)
- P & Q flows thru transmission lines
- More on admittance matrix $[Y]$ construction
Screw moves into page.
DO NOT ATTEMPT TO HANDLE, INSTALL, USE OR SERVICE THIS TRANSFORMER BEFORE READING INSTRUCTION BOOK XLL7952-12. TO DO SO MAY LEAD TO BODILY INJURY OR PROPERTY DAMAGE OR BOTH.
Admittance Approaches

\[
\begin{bmatrix}
\bar{y}_{11} & \bar{y}_{12} \\
\bar{y}_{21} & \bar{y}_{22}
\end{bmatrix}
\begin{bmatrix}
\bar{V}_1 \\
\bar{V}_2
\end{bmatrix}
=
\begin{bmatrix}
\bar{I}_1 \\
\bar{I}_2
\end{bmatrix}
\]

injected!
2-port theory

- H param (electronics)
- ABCD params
- Admittance Matrix
\[
\begin{bmatrix}
\bar{y}_{nn} & \bar{y}_{n2} \\
\bar{y}_{2n} & \bar{y}_{22}
\end{bmatrix}
\begin{bmatrix}
\bar{v}_1 \\
\bar{v}_2
\end{bmatrix} =
\begin{bmatrix}
\bar{v}_1 \\
\bar{v}_2
\end{bmatrix}
\]
Tap Changing XFRS - Variations (p.u. representations)

"From" Bus

1

C: 1

Y_{sc}

(R+jX)

2

C: 1

Y_{sc}

3

1: C

Y_{sc}

4

C is off-nominal turns ratio. In general, C is complex.

C is real for LTC.

C is complex for PS.

If |C| ≠ 1 then magnitude change.

If C is complex, phase shift.

Michigan Tech  Instructor: Bruce Mork  Phone (906) 487-2857  Email: bamork@mtu.edu