Line or cable

Unloaded

Increased load

Surge impedance loading

B1

1.0

B2

1.0pu
ATPDraw Cable Constants

ECE524
Session 36

Spring 2018

ATPDraw Cable Parameters

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Session 36

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Example

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UI
EMTDC Interface: 3 phases plus neutral

Cable interface dialog
- Shorter cables
  - Pay attention to travel time & time step
    - Especially with Bergeron model
- Short cables - model with Pi sections
  - 5 sections to get transient behavior
(5-10)
- Type of cable depends on converter topology used.

DC cables

- Some converter topologies have same polarity of dc voltage always.
- Most voltage source converters can operate with either +Vdc or -Vdc.

- Steady state - challenge for insulation.
- Two mass impregnated oil cables
- Full bridge MMC

Line commutated converters
Transformer Models

- represent turns ratio
- windy config
Low Frequency Transients

- Similar modeling info to fault programs
  » Connection information more important
- Magnetizing branch
  » Saturation
- Core loss term
- Not using per unit
  » Need to include turns ratio
  » Divide leakage L, winding R between windings

Single Phase Equivalent Circuit

- Winding resistance
- Leakage inductance
- Core loss--total losses
- Non-linear inductor model for magnetizing branch

Transformers  
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ATP Options

- Ideal transformer component
- Saturable transformer component
- BCTran -- preprocessor that converts description of transformer to coupled RL
- Can also create manually using coupled RL branches

Ideal transformer component

- Combines ideal transformer with ideal source
  » Simply enter transformation ratio
  » Can be used to implement floating source too
  » Uses frequency from basic ATPDraw settings
    - Need to make sure this matches system frequency
    - Setting "Branch = 0" forces ATP to use this frequency
    - "Branch = 1" can avoid this (Vm=1E-20)
Accessing Transformer Models

- Note that three phase and single phase options

Dialog box
Limitations

- Limited to two winding transformers
- *It is very easy to create numerical problems in the simulation with the ideal transformer*

Saturable Transformer

- Model has built-in circuit elements
  - » Winding resistance
  - » Leakage inductance (can’t enter 0)
  - » Core loss resistance
  - » Magnetizing branch
    - not entered as an L in mH
  - » Can set all except leakage to 0 to simplify
  - » Enter winding to winding ratios

\[10^{-6} \text{ mH}\]
Single Phase Saturable Base Attributes

- \( I_0, F_0 \) are steady-state point on saturation characteristic for initial \( L_m \)
- \( RMS = 0 \) or 1: determines how the saturation characteristic is entered.
- Output is information about magnetization branch

Saturation Characteristic

- If \( RMS = 0 \), this is current versus flux
- If \( RMS = 1 \), this is RMS current versus RMS voltage at frequency of first source in the system
- The 0,0 point is assumed by the program
- Up to 10 points can be entered
  » Better to limit to 3-5