Topics for Today:

- Announcements
  - Matlab to be incorporated in upcoming Hmwks.
  - Office hrs: 2-3pm M,W,F
  - Office: EERC 614. Phone: 906.487.2857
  - Recommended problems from Ch.4,5 solutions posted
  - Next: Transmission Line C Parameters, Chapter 6

Chapter 5 - Series Inductance of Transmission Lines

- Self-inductance of a conductor - recap
- Review of mutual inductance concepts - recap
- Mutual inductance between 2 conductors
- Inductance matrix for group of conductors
- ATPDraw Line Constants
- Traditional methods for per-phase parameters
  - Use of tables - standard 1-foot phase spacing.
AC Resistance \( R_{AC} @ 75^\circ C \)

- \( R_{dc} \) is max at layer \( N-1 \).
- Stead core
- \( p_{Fe} \ll p_{Al} \)
- \( J \) is highest in layer next to surface.
- \( J \) thought of as 2 or more layers of Al.
Temp Correction:

\[
\frac{R_2}{R_1} = \frac{T + t_2}{T + t_1}
\]

EQ (4.3)  
P. 145

\[
T = 234.5 - C_u
\]

\[
228 - A_l
\]

\[
t \text{ in } ^{\circ}\text{C}
\]
1 cmil = 0.001 in²

Cond Sizes:

\[ \frac{K_{cmil}}{M_{cmil}} \]

same as MCM

\[ \Rightarrow \]

MCM = 1000's of cmils.

\[ \Rightarrow \]

\[ \text{lin}^2 \]

Roman Numeral M = 1000!

See: Southwire 3M Contractor data, links on homepage.
- Self-Inductance

\[ L = 0.05 \text{ mH/m} \]

\[ L = \frac{1}{2} \times 10^{-7} \text{ H/m} \]

Continue w/ posted hand notes on Inductance.
336.4 Kcmil - Oriole.
2156 Kcmil - Bluebird.
ACCR - 3M

3M Southwire -

\[ E, \text{W/m} \quad |E| \equiv \frac{V}{r} \]

- Corona
\[ R = \frac{PL}{A^2} \quad (\text{Solid cond only!}) \]

- dc
- Solid
- Know A, Know mat'.

Empirical method to get R_Ac.


\[ \frac{R}{m/\text{cond}} \]

\[ R_{\text{tot}} = \frac{R_{\text{cond}}}{\text{No. Cond}} \]
Inductance

- Self
- Mutual
Balanced set of \([L], [C], [R]\) "Lends itself" well to per-phase calcs.

Unbalanced \([L], [C]\)
\[ \vec{V}_{B \cdot B'} = \vec{I}_a jwL_{BA} + \vec{I}_b jwL_{BB} + \vec{I}_c jwL_{BC} \]
\[ \frac{i \text{enc}}{2\pi r} = H = \text{Mag Field Int} \]

\[ \frac{A \cdot t}{m} \]

\[ \frac{\Phi}{A} = B = \text{Mag Flux Density} \]

\[ T \text{ or } \frac{Wb}{m^2} \]
\[ N_i = i \cdot \Phi R \]

Circuit: \( V = L \frac{di}{dt} \)

Ampere's Law:

\[ N_i = \Phi R = MH = 3 \]

1) \( \vec{H} \)

2) \( \vec{B} = \mu_0 \vec{H} \)

3) \( \vec{J} \)

4) \( L = \frac{\mu_0 A}{i} \)
Inductance in terms of $r$, $\mu$.

1) $H = f(I)$
2) $\vec{B} = \mu_0 H = f(I)$
3) $\vec{A} = \nabla \phi = f(I)$
4) $L = \frac{\phi}{I} = \frac{f(I)}{I}$