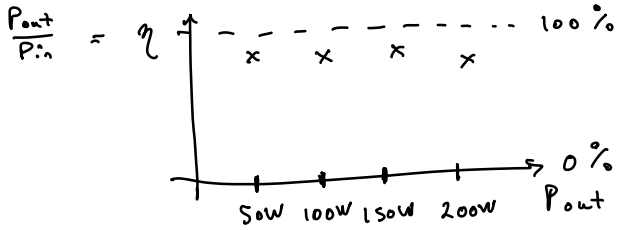
Lecture # 24, 11/29/21

- Lab
  - Tips on measuring efficiency.
  - Load resistors (50W each)

read these sections.

Today:
- Finish discussion on core losses
- Eddy currents

Goal:



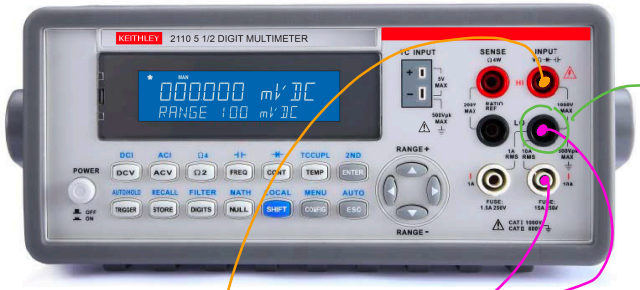
η measurement needs high precision (need $\lesssim$ 1%)

X surge not good enough

X don't trust Keysight supply readout

✓ Digital multimeters mounted on bench.

Wiring 1 DMM to measure V & i at same time.



- The "LO" terminal is common/shared between the V & I sensing circuitry.

* This method is slightly less accurate than 2 seperate DMMs.

* Key concept: Measure i returning on ⊖ terminal. Since i measurement terminals are internally shorted, this ensures the "LO" terminal is tied to the ⊖ rail of the supply.

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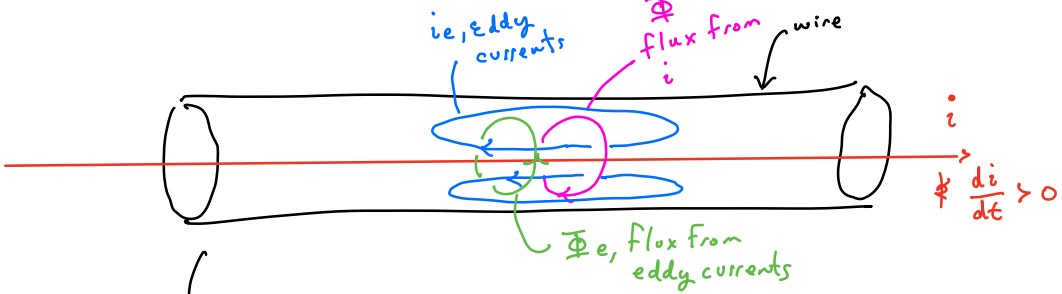
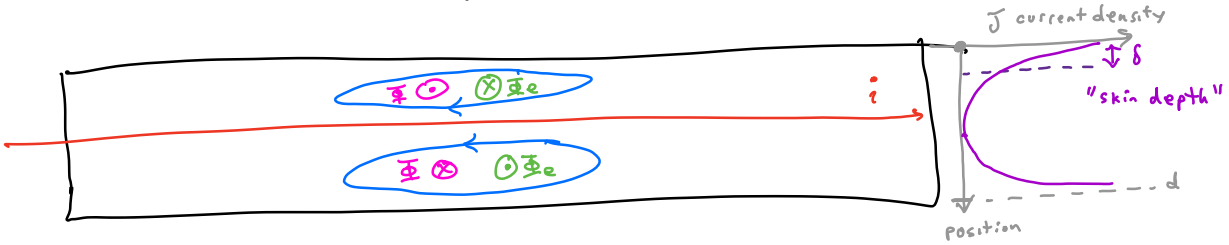
— Eddy Currents in Conductors / Coils

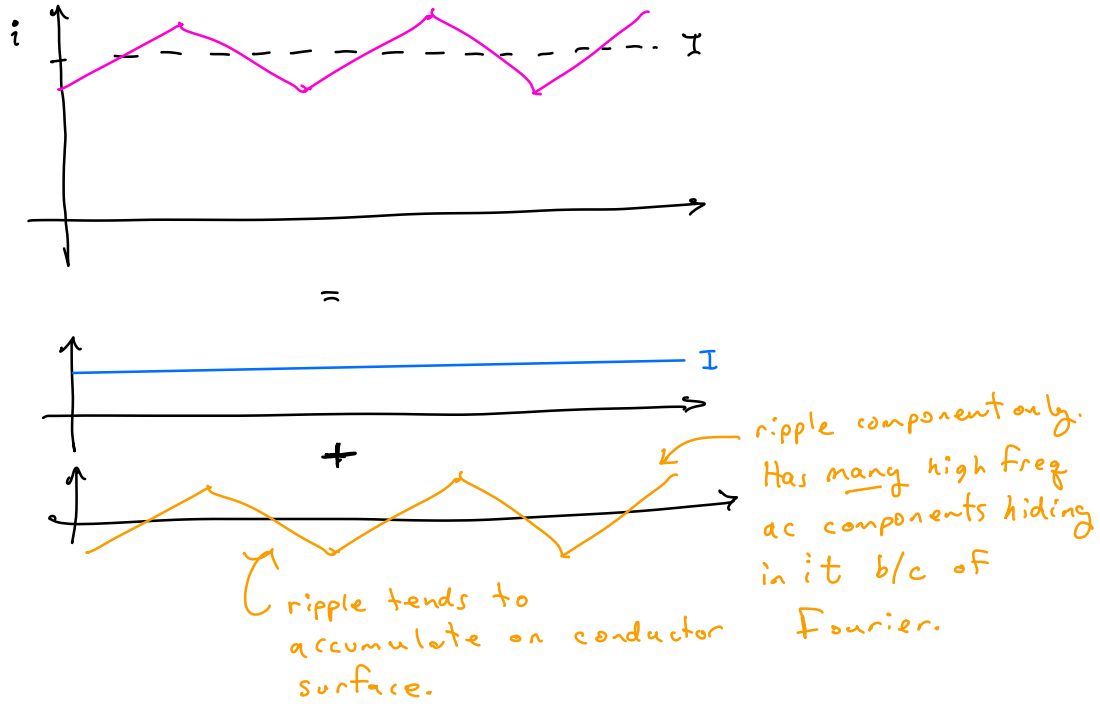
↳ A.K.A. "Skin effect"



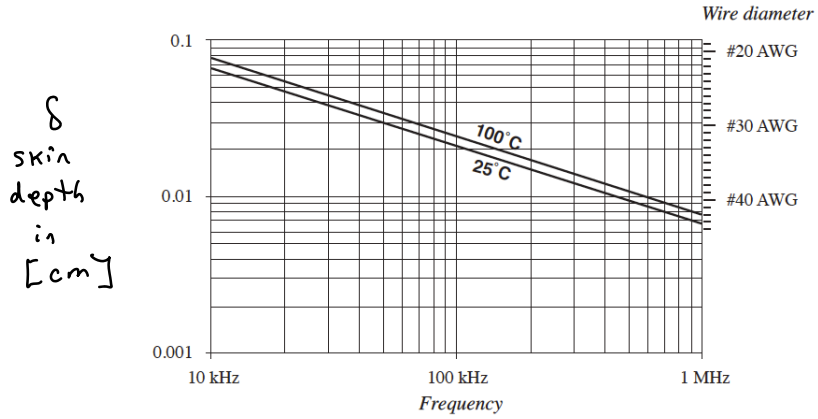
↳ look at cross-section



- Due to superposition, most of current is concentrated on surface
- Magnitidue of i_e is $\propto f$
- Look @ "dc inductor" typically used in a converter

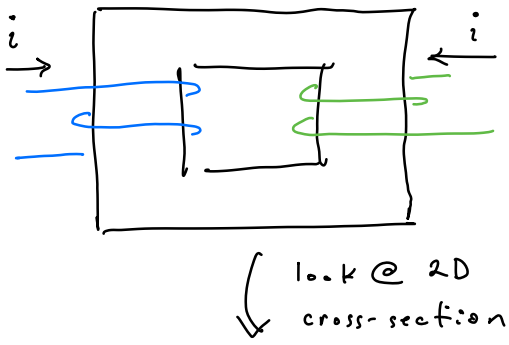


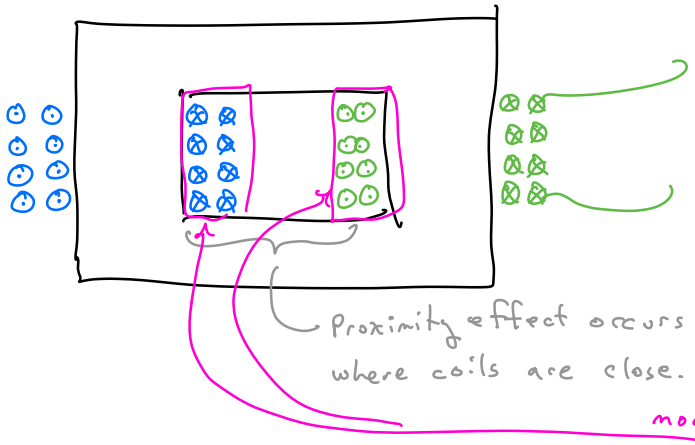
- If high freq/ripple component of i is large, then wire not well utilized & $i^2 R_{eff}$ losses ↑



– Proximity Effect (Eddy currents between adjacent coils)

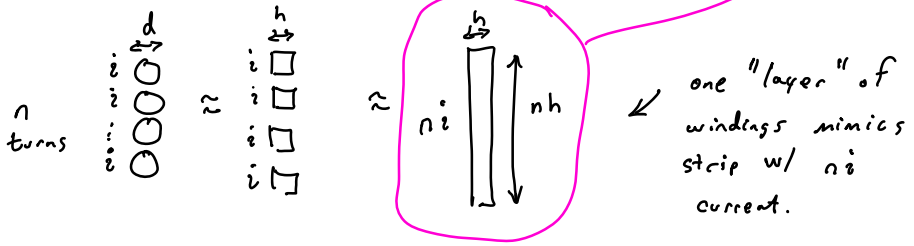
• Occurs in multi-winding magnetics (ex: xfmrs)

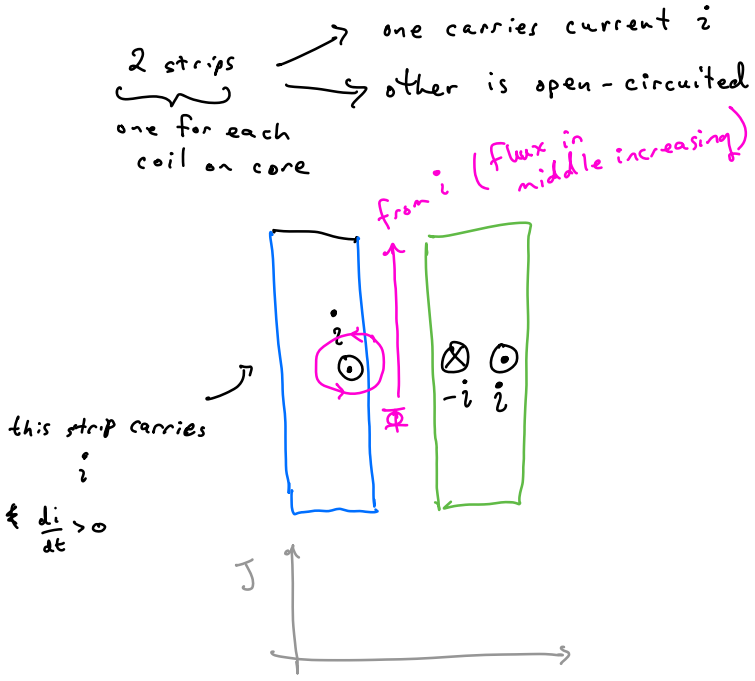


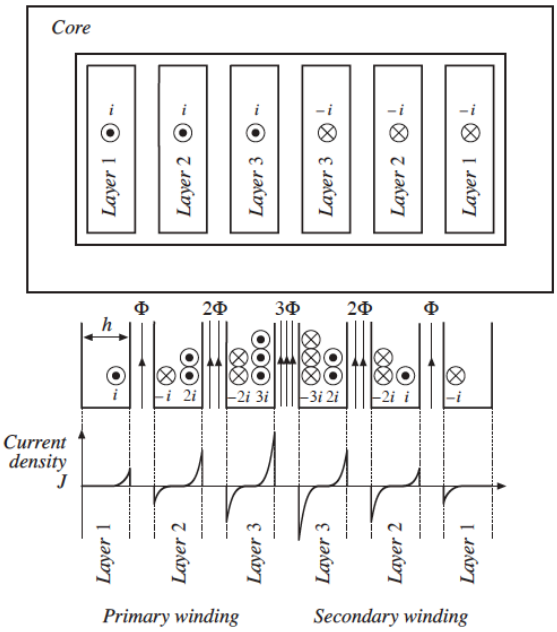


Main idea: Currents in one coil induce currents in second coil

Simple example: look @ 2 foil strips




2 strips
one for each coil on core
one carries current i
other is open-circuited
from i (flux in middle increasing)
this strip carries i
& di/dt > 0
i
-i
J


Core
Layer 1
Layer 2
Layer 3
Layer 3
Layer 2
Layer 1
h
Φ
2Φ
3Φ
2Φ
Φ
Current density J
Primary winding
Secondary winding