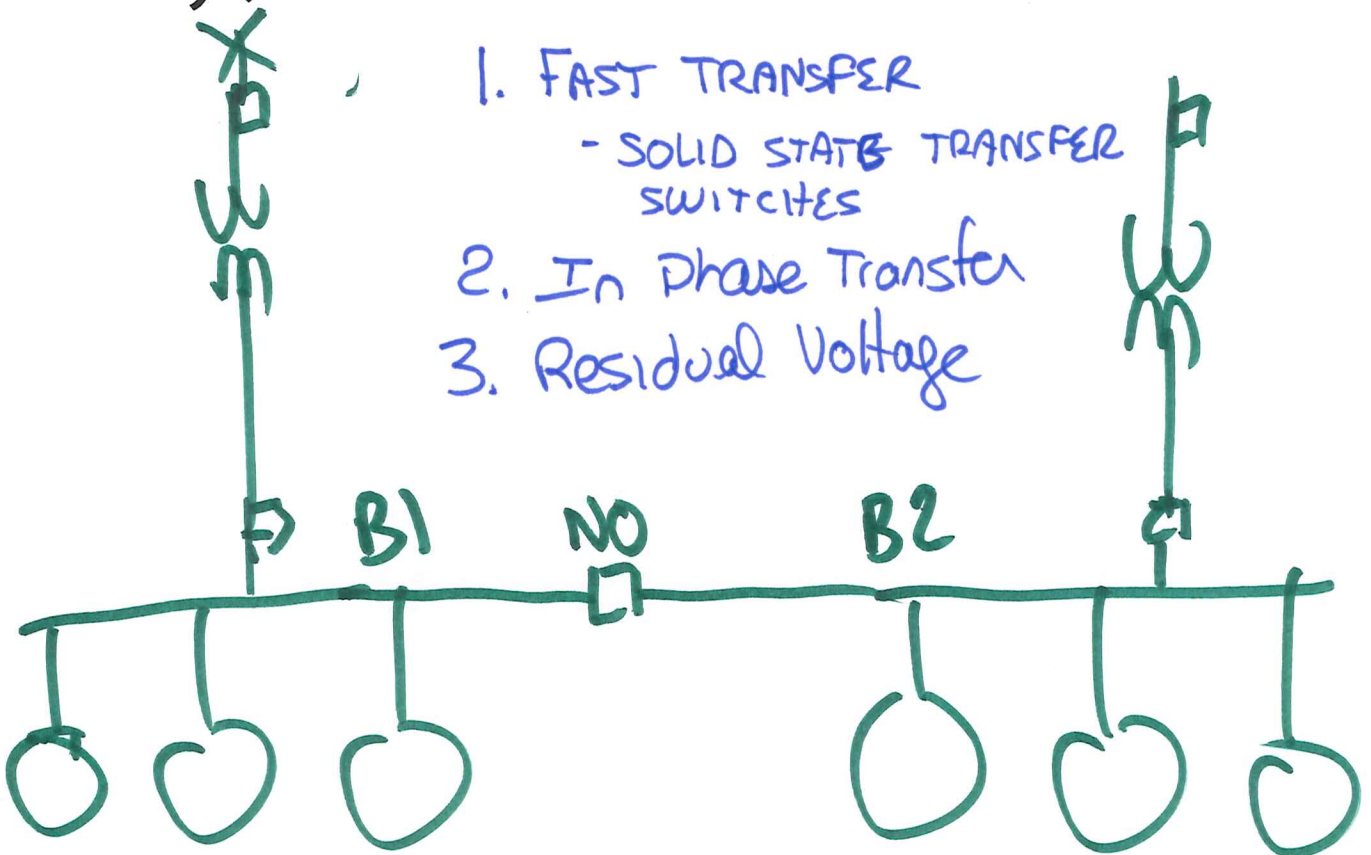
University of Idaho

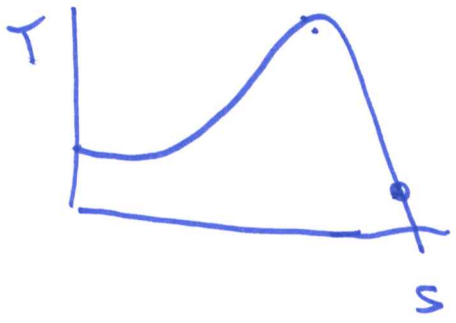
ECE 525

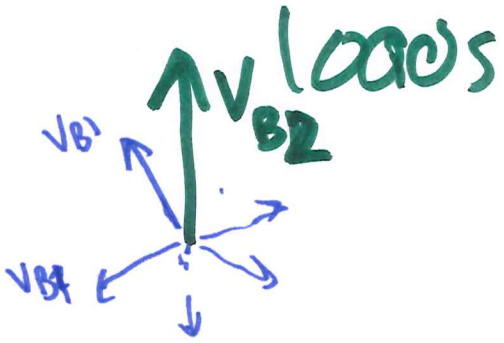
POWER SYSTEM PROTECTION AND RELAYING

SESSION no. 25

1. FAST TRANSFER
   - SOLID STATE TRANSFER SWITCHES
2. In Phase Transfer
3. Residual Voltage







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Bus Protection

- CT saturation for differential elements
  - External
    - Trip when should not.
      false trip
    - much bigger impact on system
- Restrained differential
- High Impedance Differential

High Impedance Differential

1. Expect a CT to saturate for external fault

2. If it saturates, drive it deep into saturation

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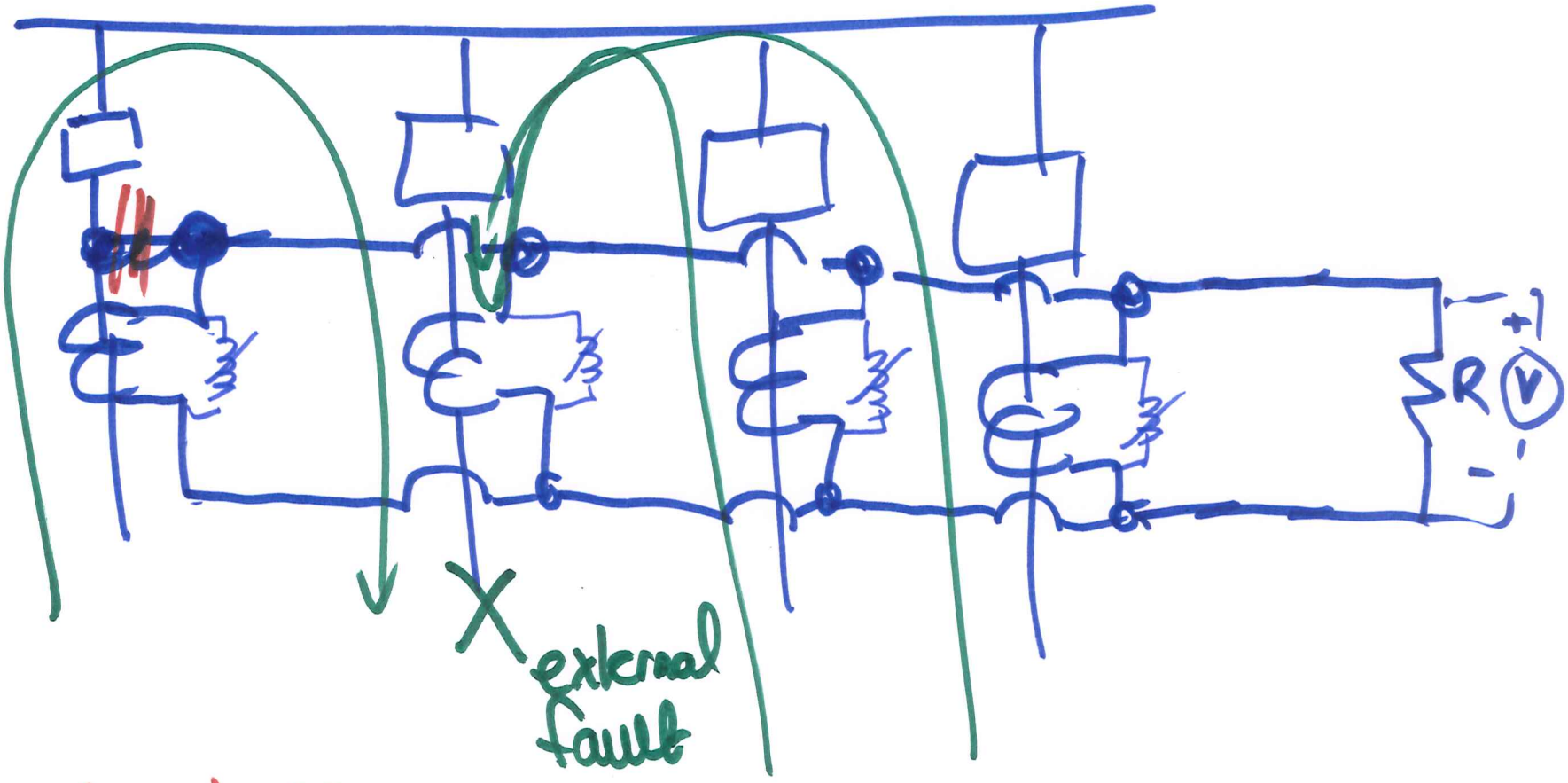
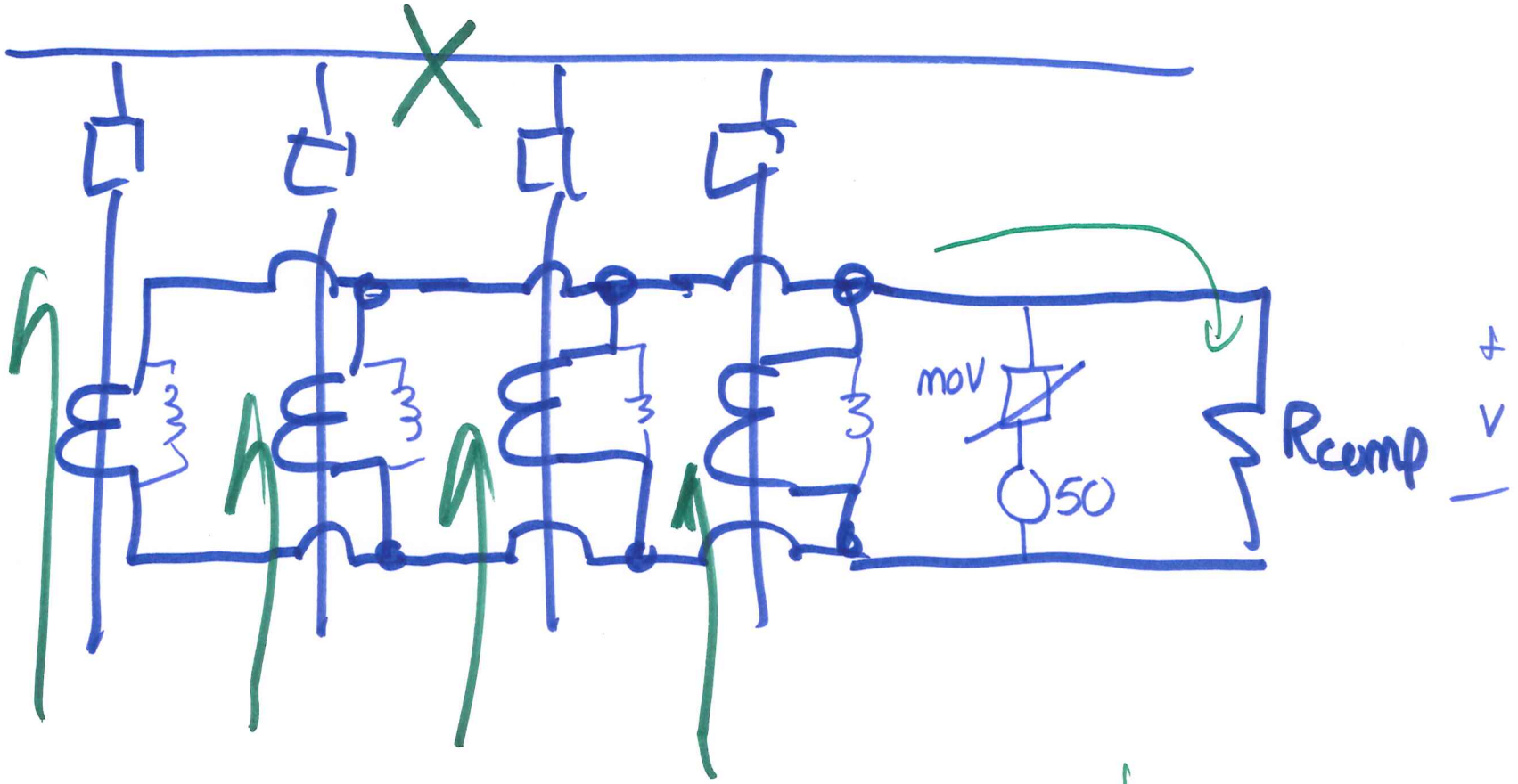


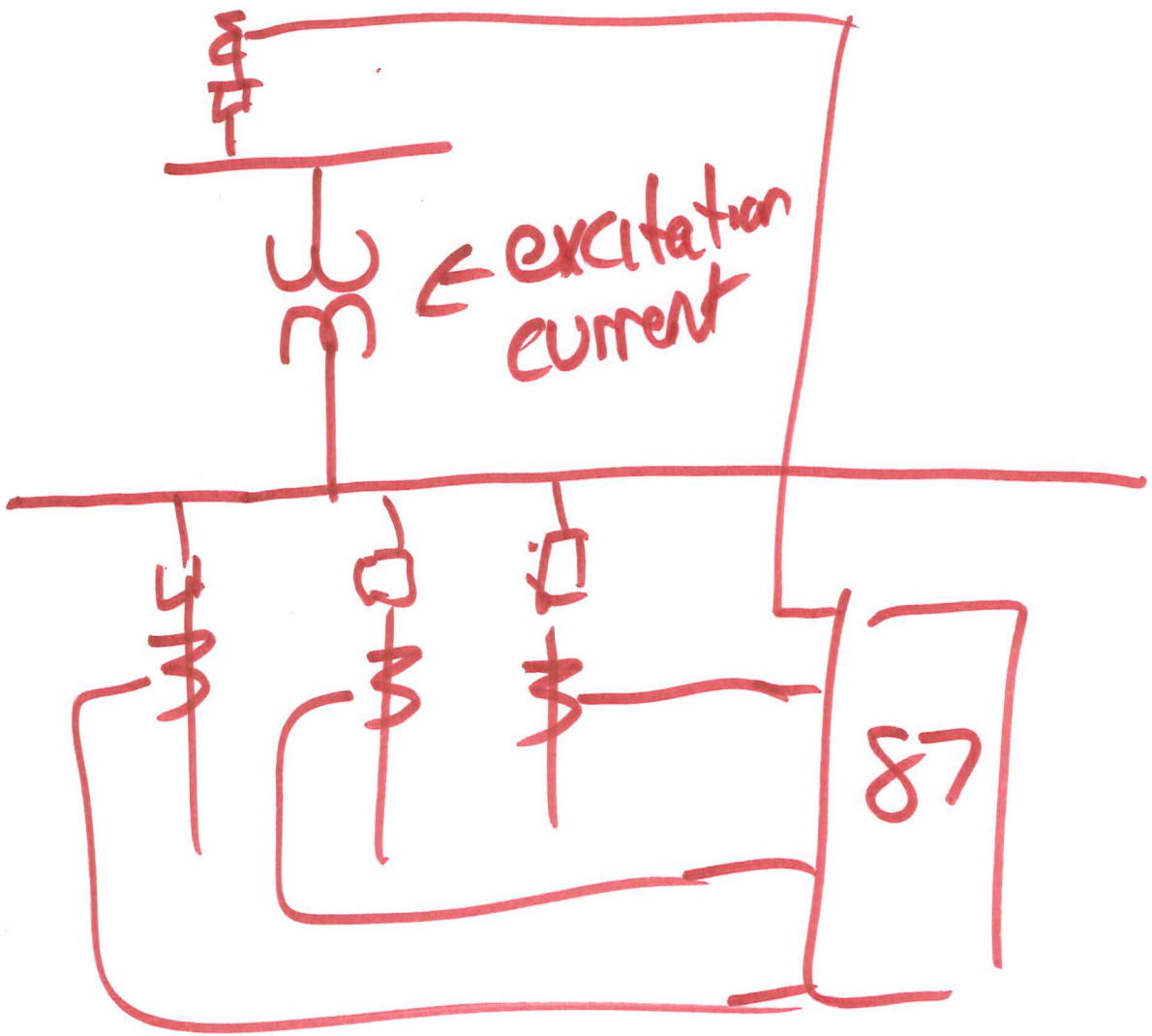
- matched CTs
  - once CT starts to saturate, drive all current mismatch into its saturated branch - due to Rcomp

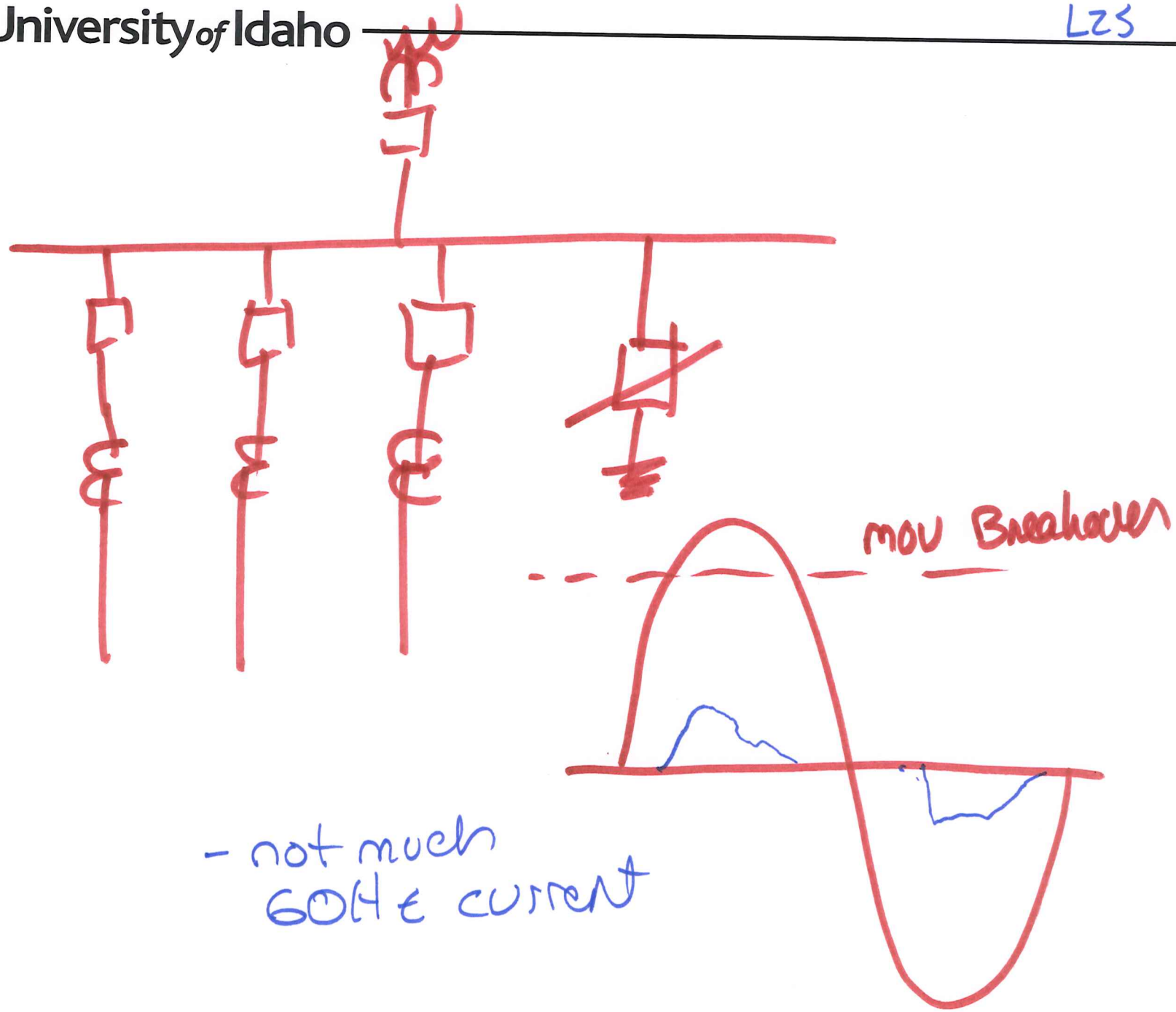


- as soon as voltage securely above threshold → trip

- Other challenges for bus protection
  - variable configurations
    - correctly accounting for all possibilities
    - CT wiring error
  - current path without measurement in the zone

Transformer in Bus Zone




MOV Breakover
- not much 60Hz current

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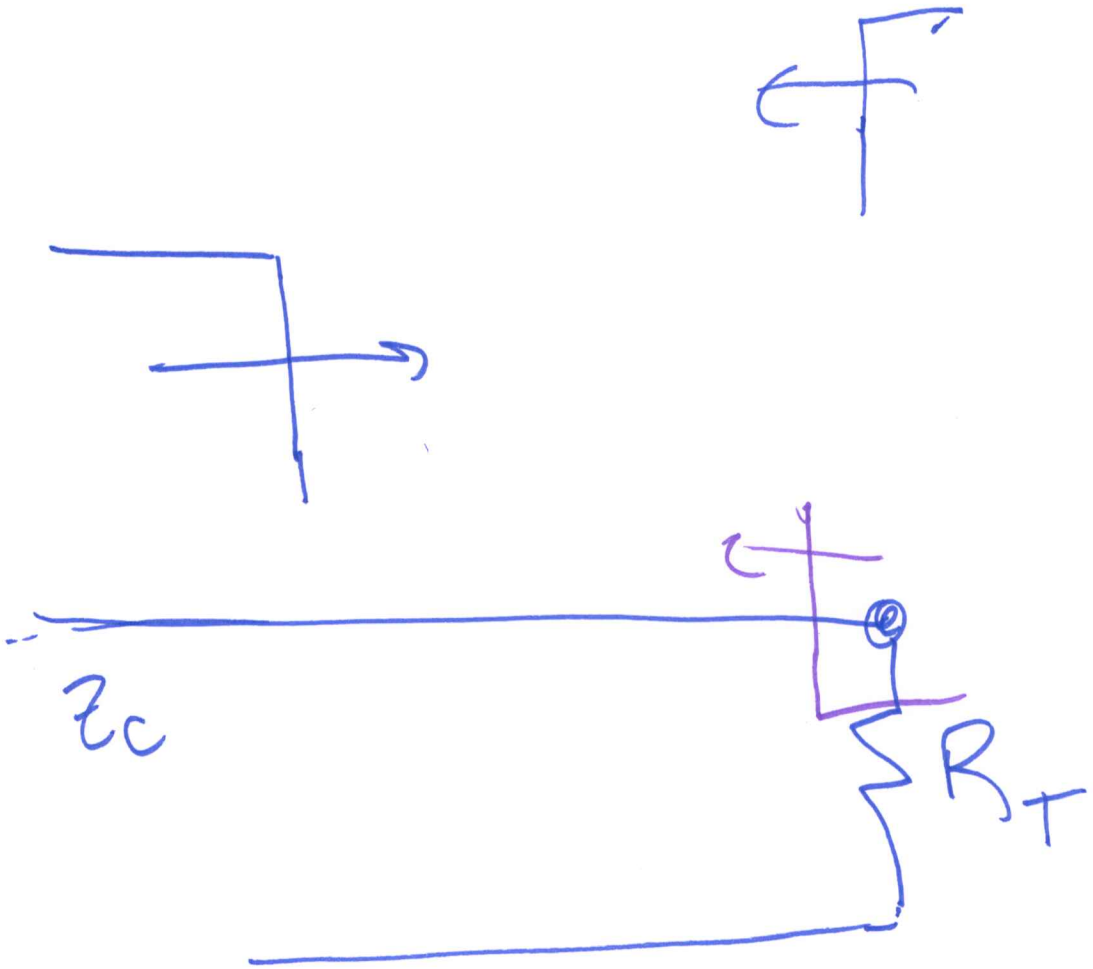

$R_T \rightarrow jX_m \| Z_{load}$

$$\Gamma_V = \frac{R_T - Z_c}{R_T + Z_c}$$

- open circuit $R_T = \infty$
  $\Gamma_V = 1$

- SC $R_T = 0$
  $\Gamma_V = -1$

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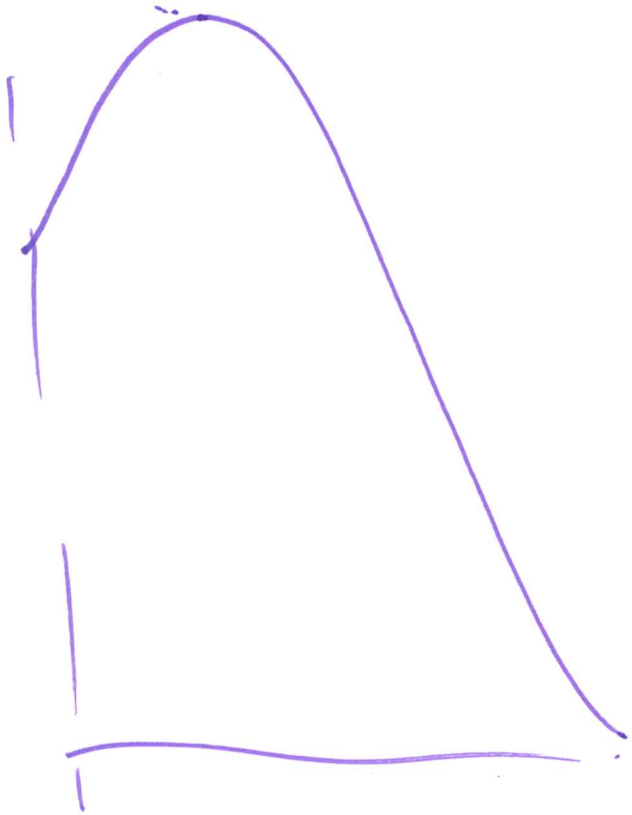

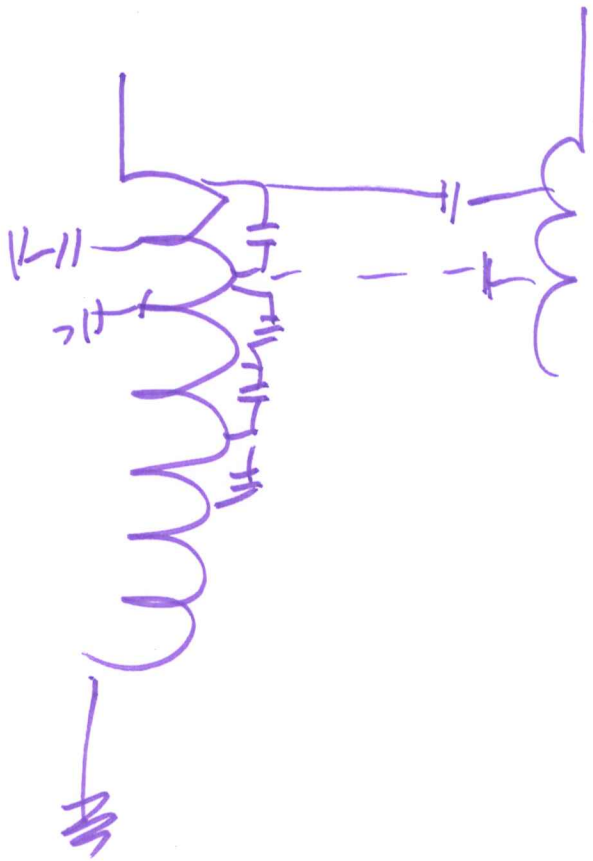

Breaker Failure Schemes

→ HISTORICALLY BF relay was a separate device

→ ~~Relay~~ Actuated by any relay function that generates a trip (62)

→ BF function checks to see if CB actually tripped

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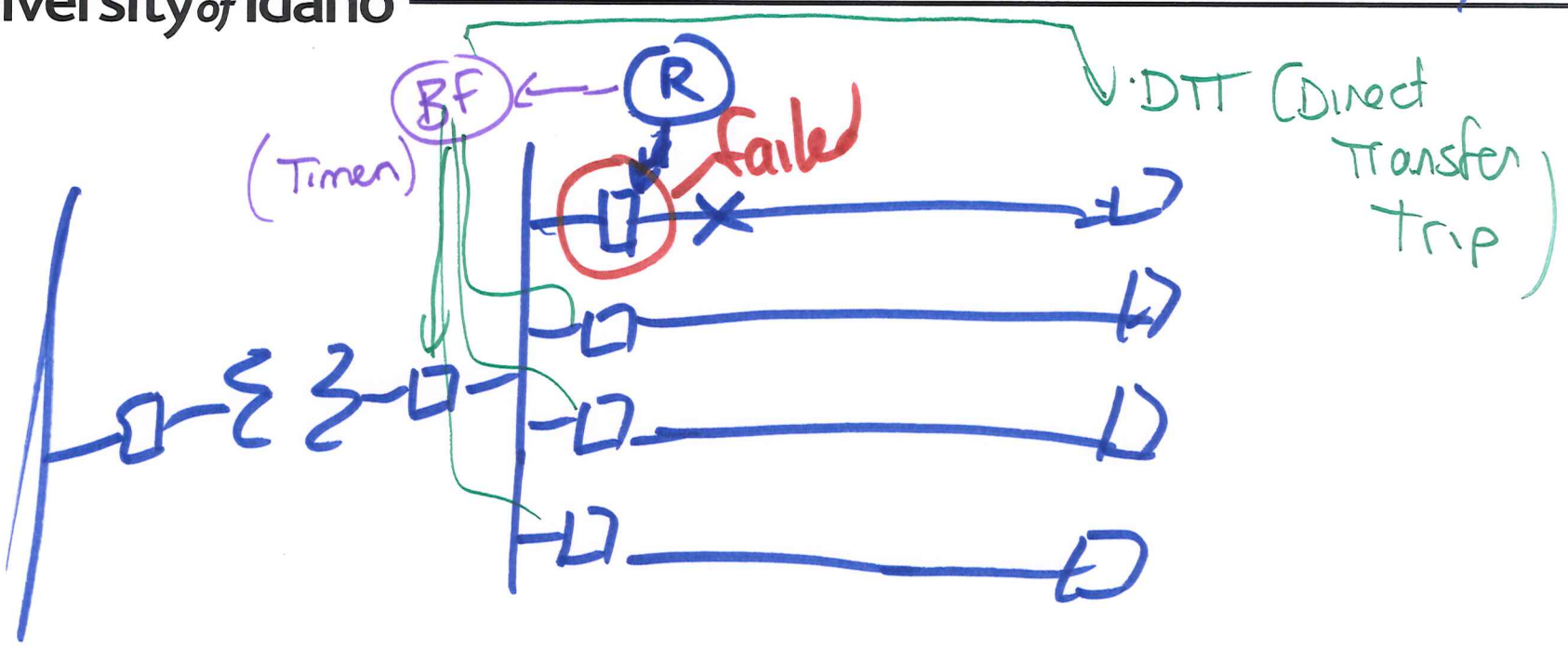
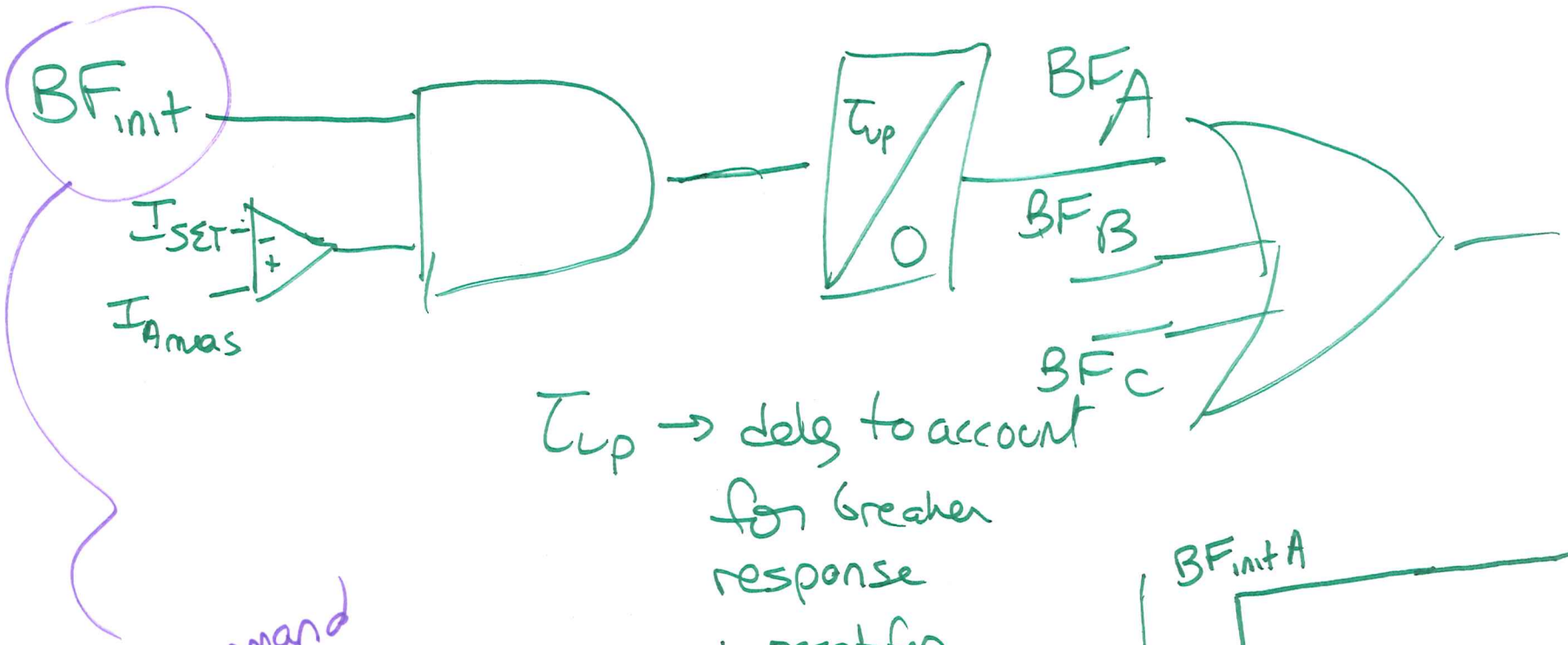


① - actuate 2nd trip coil

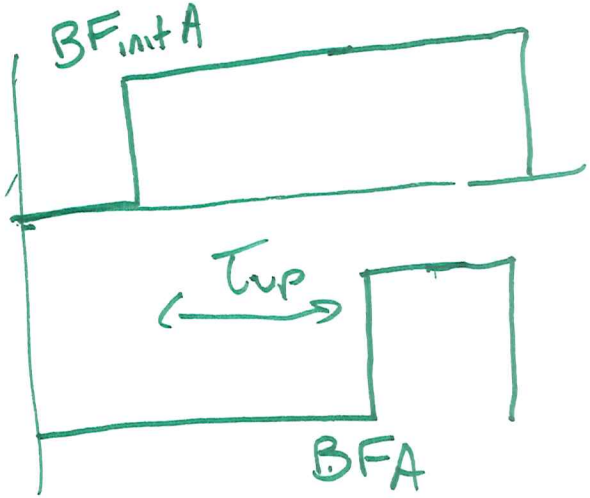
② - If still failed - trip next devices out...

Breaker failure logic - option 1

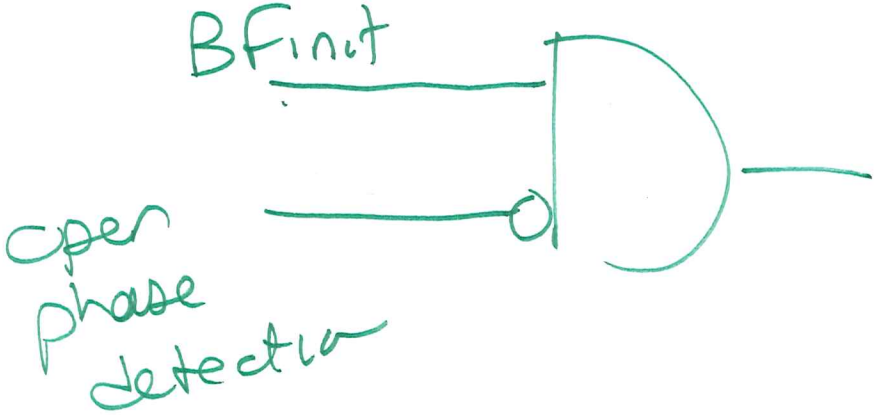


τ_{up} → delay to account for breaker response + reset for fault detect

Trip command to any of the 3 Breaker failure Zones



Other inputs



Transformer Protection

→ Fault protection of transformer itself

→ Protecting transformer from external conditions & through faults