System Protection

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What is the difference between having a fault at points x and y?
• A directional relay is not necessarily an over-current relay.
• By using a directional relay, we can determine the direction of power flow and trip the circuit accordingly.
A System with Directional Relay

A directional relay and an over-current relay are connected in “and” configuration to initiate the correct fault clearing action.
Impedance Relay

(a) Fault at 60% distance line.
   • Action: Trip
(b) Fault at 80% distance line
   • Action: Marginal Trip
(c) Fault at 100% distance line
   • Action: Block
(d) Fault at just beyond the zone
   • Action: Block
(e) Much beyond protected line
   • Action: Block
(f) Typical normal operating condition
   • Action: Block
(g) Fault at the left of the protected line
   • Action: Trip
(h) More distant fault
   • Action: Block
• This relay is also known as “Distance Relay”
• This relay can determine the distance between the breaker and the fault location.
• Impedance relays are used to define protection zones.
Differential Protection of Generators

- Compares the incoming and outgoing currents to determine any internal fault.
- The differential current needed to trip the breaker is a function of the generator current.
If the value of $k$ is increased, the relay becomes less sensitive.
Differential Protection for a Transformer

Two issues:
• Transformer inrush current
• Transformer s with voltage regulation