

# SAARC Training Workshop 'Power System Studies for Synchronization of Multiple Systems'

## Applying Fault Types in PSS/E

Day-3-F

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SAARC Energy Centre, Islamabad  
[www.saarcenergy.org](http://www.saarcenergy.org)



[hassan@powerplannersint.com](mailto:hassan@powerplannersint.com)  
[www.powerplannersint.com](http://www.powerplannersint.com)

# Three Phase Fault

- Most severe but not so common
- From Planning Perspective, the robustness or strength of the system is tested by applying 3-phase permanent fault
- Fault clearing time = 5 cycles including relay time and breaker parting till complete extinguishing of arc)
- PSS/E applies a huge admittance  $-2e^{+9}$  at fault location to “shunt” the entire system
- PSS/E has the option to apply “Bus Fault” and “Branch Fault”. But for worst case severity the fault is normally applied at Bus with permanent trip of a line emanating from that Bus

# Single-Line-to-Ground Fault

- Less severe but quite common fault in the system
- The fault admittance will vary from location to location and it is calculated by PSS/E and then applied using the option of Unbalanced Faults to “Calculate and apply bus fault” or “Calculate and apply branch fault”
- Fault clearing time is 5 cycles.
- PSS/e can also apply other unbalanced faults i.e. Line-Line (L-L) or Line-Line-Ground (L-L-G) by using the same option of Unbalanced Faults to “Calculate and apply bus fault” or “Calculate and apply branch fault”
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# Auto-reclosing after SLG

- Sometimes SLG fault is transient fault and the faulted line may be auto-reclosed after dead time of 300ms – 350ms
- Reclosing may be Successful or Unsuccessful depending on the fact if the fault persisted or not.
- As a worst case scenario in Planning studies, Unsuccessful reclosing is tried to test the robustness of the system
- Not more than one-shot is permitted i.e. if reclosing is unsuccessful 2<sup>nd</sup> shot for reclosing is locked-out
- No autoreclosing is permitted after 3-phase fault as it is normally considered as permanent and is too severe to give a 2<sup>nd</sup> shot.

# Single-Pole Autoreclosing

- Sometimes, to increase reliability, the option of single pole autoreclosing is also used in case of SLG faults
- During fault clearing only the faulted phase is opened
- After dead time the same faulted phase is reclosed.
- The detailed Short Circuit calculation activity SCMU is used to calculate the admittance to model this type of fault clearing and autoreclosing

# Single-Pole Autoreclosing

- Single Pole autoreclosing may have some adverse effects on turbine/ generators in terms of sub-synchronous resonance causing torsional stresses leading to fatigue on the shaft that might not be acceptable
- This option is very carefully tried after making sure by performing sub-synchronous torque interaction studies by EMTP software such as PSCAD/EMTDC