Impact of inverter – based ressources on transient stability and consequences for protection performance requirements

Protection And Automation B5
PS1 Q1.04 Are there any key considerations
for securing the ROCOF protection against
maloperation?

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Are there any key considerations for securing the ROCOF protection against maloperation?

- SAGC requires RPPs to detect an Islanding condition, and to tripping within 2 sec.
  - ➤ ROCOF is one of the ways to detect islanding by RPPs
  - ➤ SAGC stipulates that RPPs should only operate for ROCOF that is above 1.5 Hz/s.
  - ➤ ROCOF elements can thus not be set more sensitively than 1.5Hz/s.

- Eskom Tx has experience with the application of ROCOF protection for the detection of power network islands - blocking UFLS protection
  - ➤ UFLS relay operations during islanding conditions - are a nuisance requiring additional switching to restore supply

- An Eskom Tx study into causes of UFLS relay mis-operations highlights four network scenarios, that have led to mis-operations of level-detection frequency protection
  1) Voltage ring-down events;
  2) Rapid voltage changes due to network faults;
  3) Rapid voltage changes due to secondary VT circuit connection problems; and
  4) Islanding.

Group Discussion Meeting

- Scenarios (1) to (3) can be expected to also cause mis-operation of instantaneous ROCOF elements set for islanding detection by RPPs

- A recognised way of stabilising UFLS relays from misoperation, is the application of an "average ROCOF" function

  ➢ An average ROCOF function – provided by some IED brands
  ➢ Based on two level detection elements that are set a with a freq diff ΔF.
  ➢ A timer is started when the Fm crosses the upper freq threshold - IED checks the Fm a set time, Δt, later
  ➢ If Fm at set time (Δt) is lower than the lower set freq threshold, then the avg ROCOF is higher than the setting, and the relay operates.

- Eskom experience is that average ROCOF elements are much more secure and reliable than instantaneous ROCOF elements.

- By assessing ROCOF over a set time window, mis-operations due to short duration network disturbances, such as scenarios (1) to (3) can be avoided
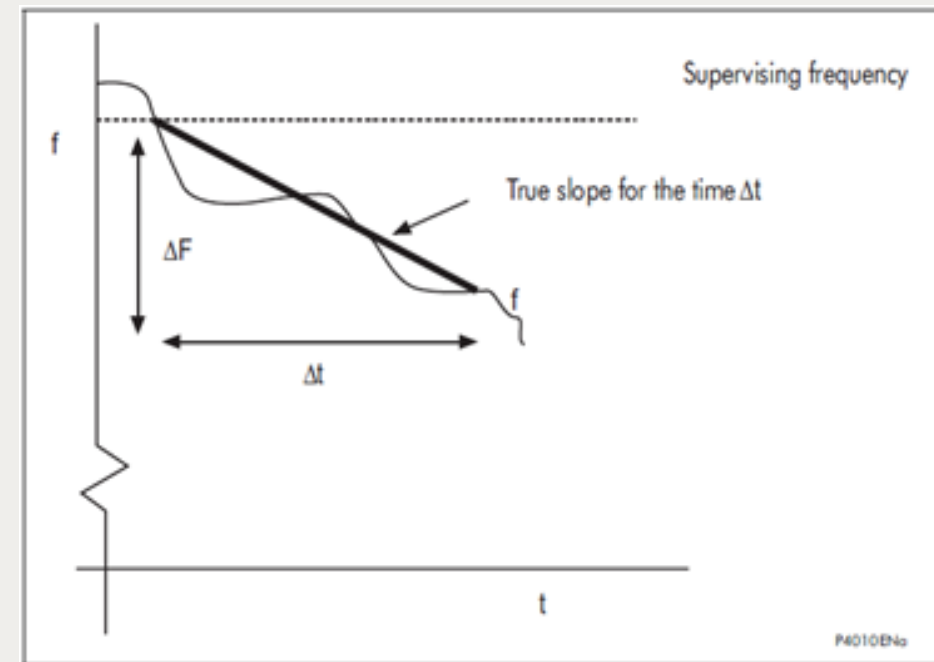
➢ In RPP applications where tripping for an islanding condition is only required within 2 seconds, an average ROCOF time window of 0.5s could be applied.

➢ It is surprising that more IED manufacturers do not include average ROCOF protection elements in their IEDs