

B5 – PS2-2.06: What are the key innovation for an intelligent algorithm-based protection and how to address challenges during the application of the proposed protection schemes?

In many Transmission and Distribution Network Operators the demand for electricity is growing fast and is exceeding their supply capability and such increase in demand is pushing the stability limits of the network which ultimately will result in loss of supply, or “black outs” as witnessed in recent years. Losing a major transmission line within a network can result in excess generation that may send too much generation and overload the interconnection between two networks. In the same way, losing a major generation source in a network can result in a lack of local generation that may draw too much generation and overload the interconnection.

However, protecting the interconnections comes with their own challenges and it is required an alternative approach to operate the existing system smarter by monitoring power system quantities and taking automatic control decisions and action based on the state of the power system, that can react to wide-area instabilities within several hundred milliseconds. Such systems are often referred to as System Integrity Protection Schemes (SIPS).

Challenges of interconnections can be summarized as follows:

1. Overloading Interconnect:
2. Underfrequency / Undervoltage:
3. Over frequency / Overvoltage:
4. Oscillations

To employ a SIPS it is necessary to carry out a system study and RTDS tests becomes as a mandatory requirement for factory acceptance test (FAT) to validate all dynamic test scenarios, give confidence that the system operates correctly and enables to reduce commissioning time and minimum disruption to the operational network.

SIPS are complex to test due to the requirement to recreate the network dynamic conditions which generate the signals (voltages and currents) and test the closed-loop response to the different algorithms of the Wide Area Protection Scheme. A methodology for testing SIPS is required and must include the following tests:

1. Functional Element Tests;
2. Interoperability Tests;
3. Integration Tests;
4. Systems Tests;

Different testing methodologies must be considered for contingency action solutions such as black box and white box testing to ensure all the functions and their connections are tested. Similarly, for oscillations detection several operational scenarios must be replicated to simulate oscillations and understand the behavior for taking corrective actions such as dampening of oscillations by bringing on PSS (power system stabilizers).

When SIPS is applied in WAMPAC schemes the measurements, coming back from different parts of the system, must be synchronized to be accurately compared and we need to have a reliable communication system to allow all the required data shared in the system.