SIMON RICHARDS
COUNTRY : UK
REGISTRATION NUMBER : 7121

GROUP REF. : B5
PREF. SUBJECT : PS1
QUESTION N° : 1.05

Q1.05: Are there any changes to power swing characteristics in lower inertia grids which would prompt changes to power swing blocking or out of step tripping protection settings or schemes?

Historically, power swings have been generated by the movement of the rotor shafts between multiple synchronous machines connected at different points on the grid. As a disturbance occurs, the mechanical inertia and governor responses of those machines will set the oscillatory response. In such systems, that inertia serves to restrict the spread of swing frequencies that are possible, such that traditional impedance bands surrounding the distance zone starting characteristics have proved reliable.

With such a diverse nature of machines being connected to the grid, this means that part of the generation will have inertia – for example thermal and nuclear plants, but much of the connected generation will have either zero inertia, or a software-replicated pseudo inertia set by the control response of the IBR inverter-fed controller, or the HVDC infeed.

This can lead to a plethora of different swing frequencies and profiles, with the grid operating potentially close to its dynamic stability limits. Think of it as multiple people jumping on a trampoline, if all jump together at « synchronous speed », the team will move together and stability might be possible. However, if a heavier person lands just before a light person, it is likely that the latter will fall over. This is akin to the loss of synch that can occur on today's grids, either by power swings developing quicker or out-of-step pole slips occuring.

An adaptive algorithm is better-placed to detect the power swings, one that is not constrained to impedance bands and timers. The technique employed looks at rates of change in current and whereas this delta will tend to stabilise for faults, for a power swing the delta will persist. This can be used to detect power swings in a settingless way.

The technique is robust, even able to unblock near instantly if a fault were to develop during the power swing.

Extensions to the technique also permit controlled grid separation in the event of an out-of-step event.