Ricardo
Energy & Environment

# Novel technique for detecting nested faults in networks

Nested faults are faults that occur on networks that are already affected by other faults. They are often associated with extreme weather events (such as storms or floods) which can cause damage in several areas in a short period of time. In many cases, the Distribution Network Operator is only aware of the fault at the highest voltage level, and any nested faults are hidden.

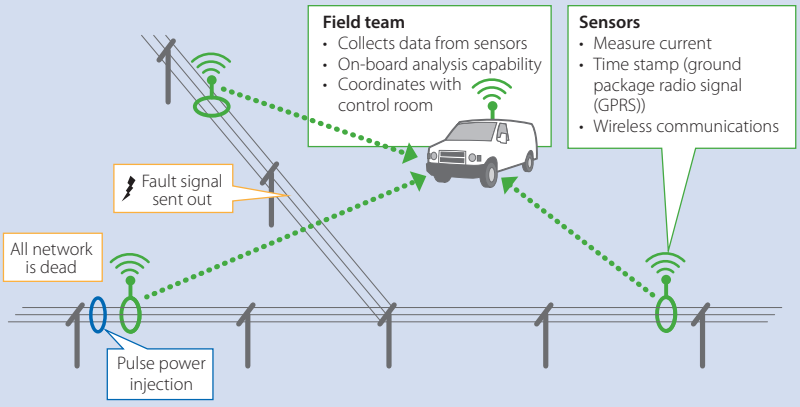
When the known fault is cleared, the network is energised, but some or all of it may immediately trip again as the nested faults create events on the network. These faults then need to be identified and cleared in turn. The effect of this is that customers connected to some sections of the network are likely to be disconnected for a significant time.

An additional issue is created by the lack of direct network monitoring at lower voltage levels. This means it is not always possible for the control room to be certain which areas of the network remain disconnected.

## Proposed concept

Where a network is already out of service due to an upstream fault, pulse power could be injected into a section of the downstream network. This would cause nested faults to emit an electromagnetic signal and hence enable their detection. The diagram below illustrates the potential solution.

Below is an illustration of how nested fault detection could be carried out if there was no live infeed (e.g. where a large area of the network is dead).




**Possible sequence of events for detecting nested faults in networks:**

1. **Sensors are deployed** at the edges of a defined zone.
2. **Pulse power is injected** into the network to set up a fault signal.
3. **Sensors measure current** and send time-stamped data to field team.
4. **On-board analysis** determines location of the fault by comparing the time stamps of the event signal.

For more information on our novel technique for detecting nested faults in networks, please contact one of our experts at enquiry-ee@ricardo.com or +44 (0) 1235 753000