

8 Future Recommendations

There is much more that can be done with this model. The goal of this study was to prove the feasibility and effectiveness of this device, not to develop an absolutely complete model. Several desirable features are not included. One of these features is an event log. This log should record all operations, including trip inputs from existing relays, until cleared. One of the useful features of this log is to indicate what existing relays may have hidden failures. Also along these same lines, the RSS does not do any fault classification, nor does it calculate fault location. This is important information for analyzing any fault event, and the next step in working with this model should be adding these capabilities. Another possibility is the RSS could also log the values of waveforms of the effected lines during a fault event, acting as a limited fault recorder.

The RSS model only considers one hidden failure mode at a time, as this is the most likely scenario. There are weaknesses to this. One example is the common practice of using a distance relay as the distance and fault detector components of a directional comparison blocking scheme, while using this same distance relay as the backup to tripping the line. If this distance relay fails, both protection schemes will provide trips to the RSS. The normal operating mode prevents any false trips in this case, but the Emergency mode may permit the trip.

Communications is a feature not accurately included in the model. The system operator must be able to control the operating mode of the device remotely. In the RSS model, a user selectable switch represents this communication capability. A communications feature not included in the model is the ability to communicate back to the system operator. Another possible use of communications is to allow remote setting of relay functions.

One capability not modeled is the ability to self-test for failure. This is a desirable feature in an actual system. The self-test function would regularly test all the system components. If a component failed, the RSS would remove itself from service, and send an alarm to the system operator. This is a feature to add to an actual, physical model.

A final possibility to include in further work is the concept of adaptive relay settings. It may be desirable for some of the relay modes to adapt their settings for changing system conditions. One simple way to implement this is through the idea of settings groups. The relay stores a series of settings to handle specific system conditions. As system conditions change, a new active setting for the relay is chosen from the settings group. An example of this is for distance relays protecting a line that has infeed. With the infeed in place, one setting is desirable. With the infeed removed, another setting is desirable. This adaptive operation could work on command from the system operator, or it could be performed automatically by communicating with the infeed terminal. A settings group to provide adaptive protection should be easy to model and implement