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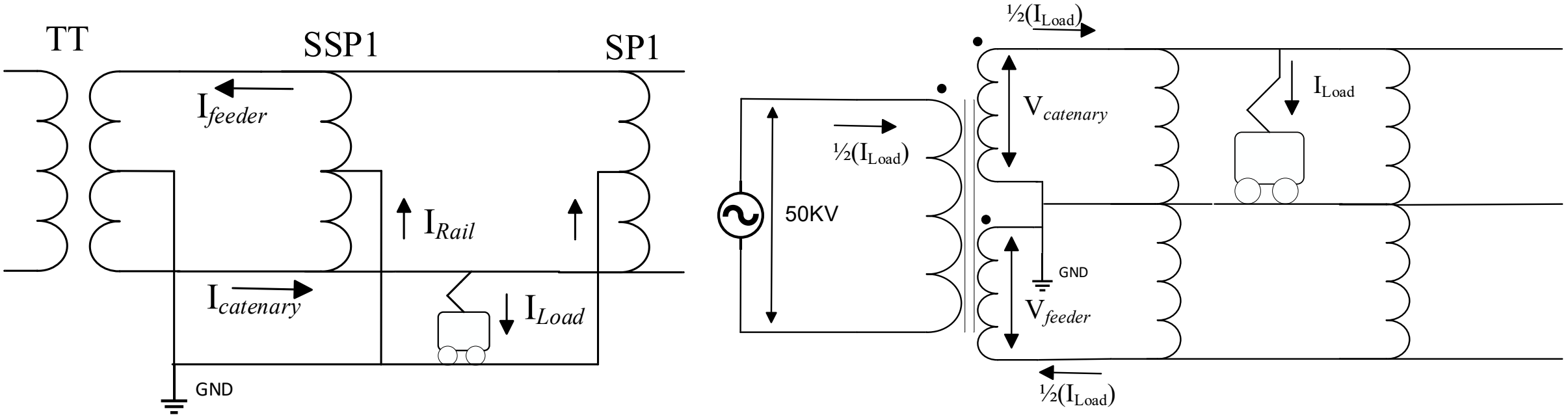
Fault Location Challenges in Traction Power Delivery System with Autotransformer

Presented By

GURUJITH A, Intern, Hitachi Energy

INTRODUCTION



Traction AT connection

- By using the AT, the traction section length can be significantly increased.
- Fewer substations With fewer maintenance is less.
- Reduces the burden on the catenary conductors.
- AT is widely used in the traction power delivery system.

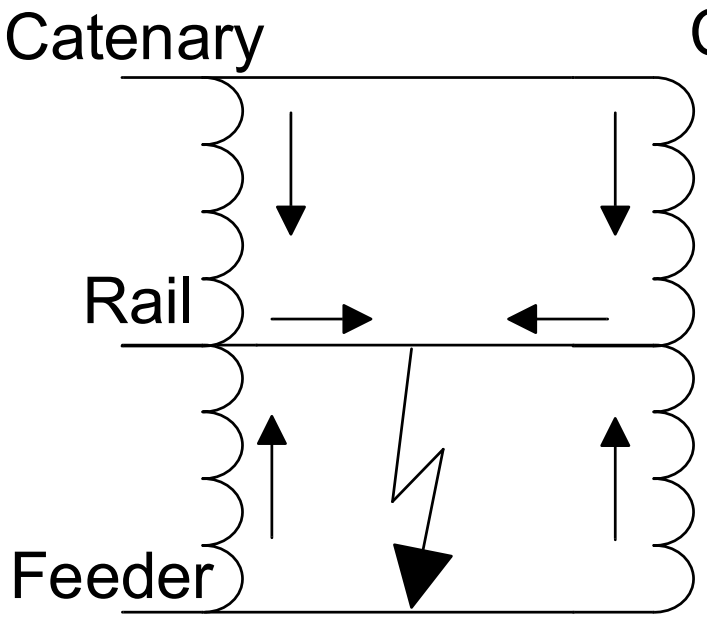
CONTEXT

- The advantage of AT in traction power delivery systems comes with a price, i.e., it makes it difficult to find the fault location.
- Finding the fault location in a traction system with voltages and currents from TSS is not as straight-forward as in the case of a three-phase transmission system.
- In traction systems, the identification of the faulted section is difficult because of the presence of the AT.
- As the load is connected to the system, discriminating the fault current from the load current is difficult.

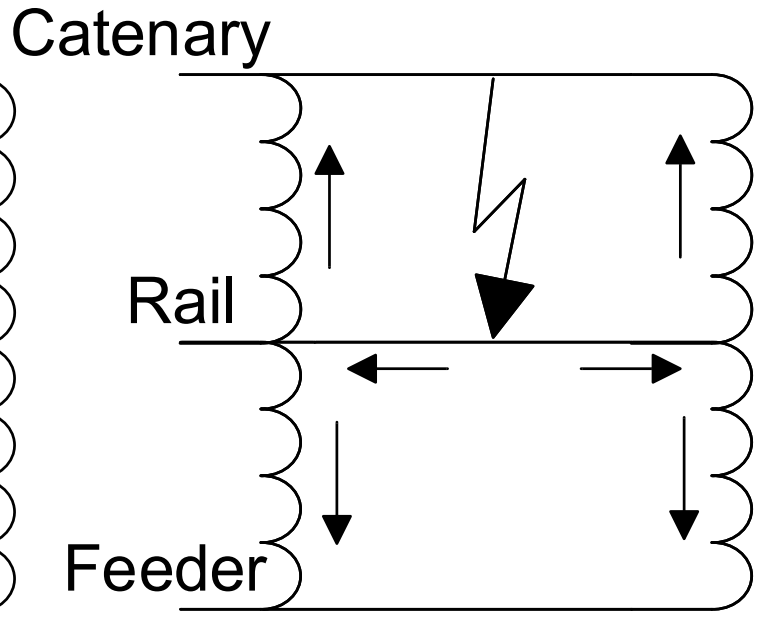
RELEVANCE

- Indian railways is one of the busiest mode of transportation, so any kind of delay must be reduced.
- Making the traction system more reliable by finding the fault location more accurately and in less time.

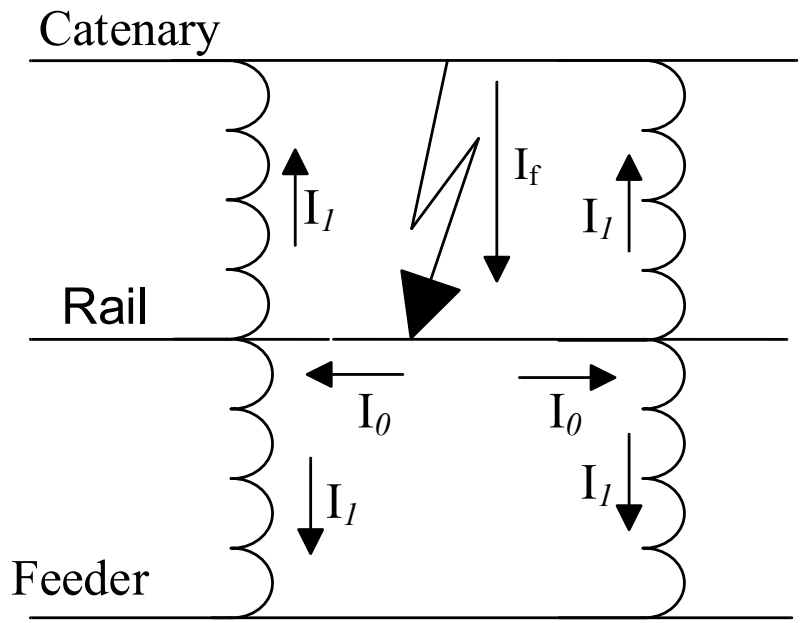
Fault Location Challenges (Effect of Auto-Transformer (AT))



(a) Feeder to Rail fault



(b) Catenary to rail fault

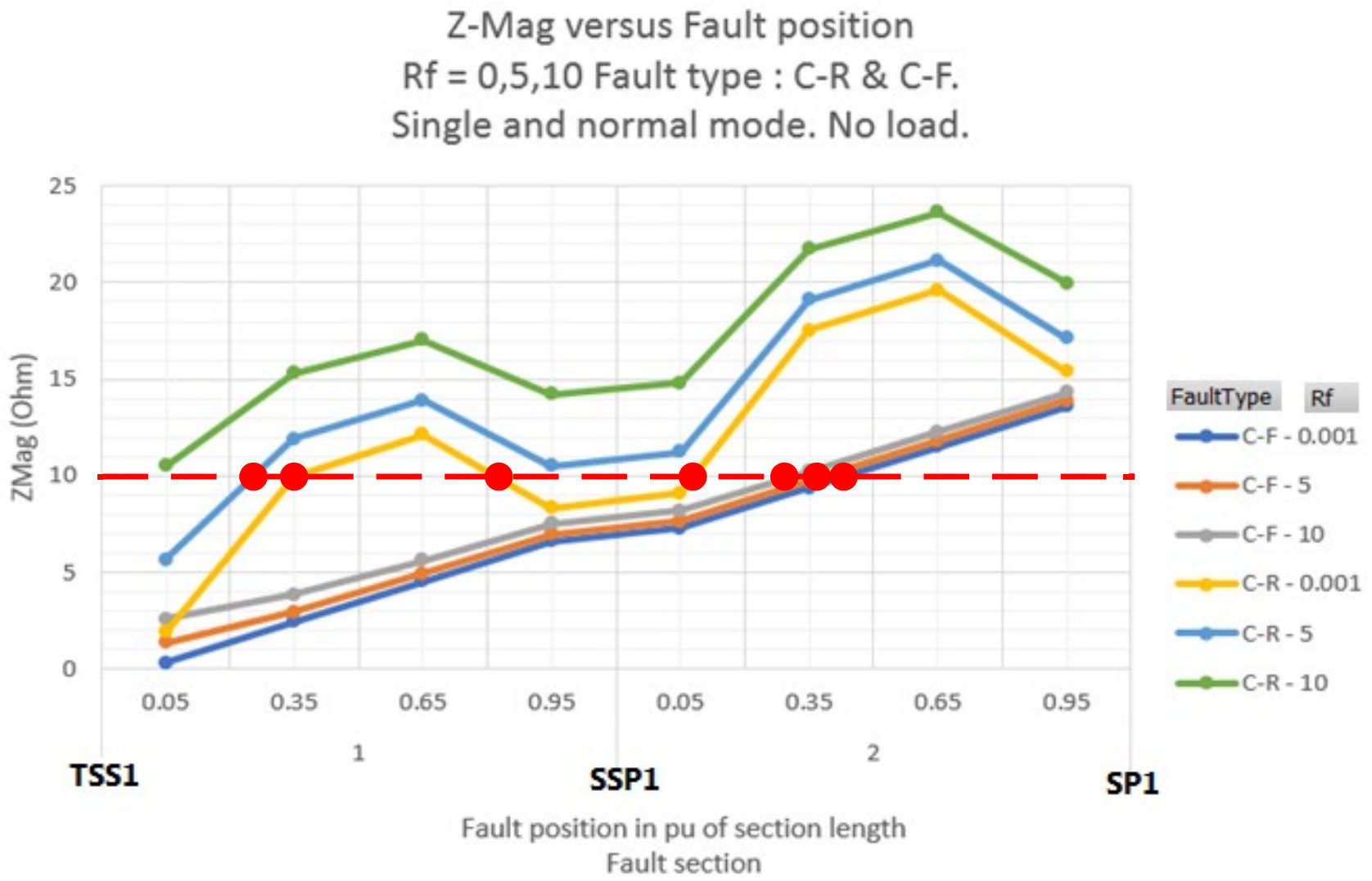


Zero sequence filter

- The magnitude of the current injection depends on the position of the fault (considering the same fault impedance).

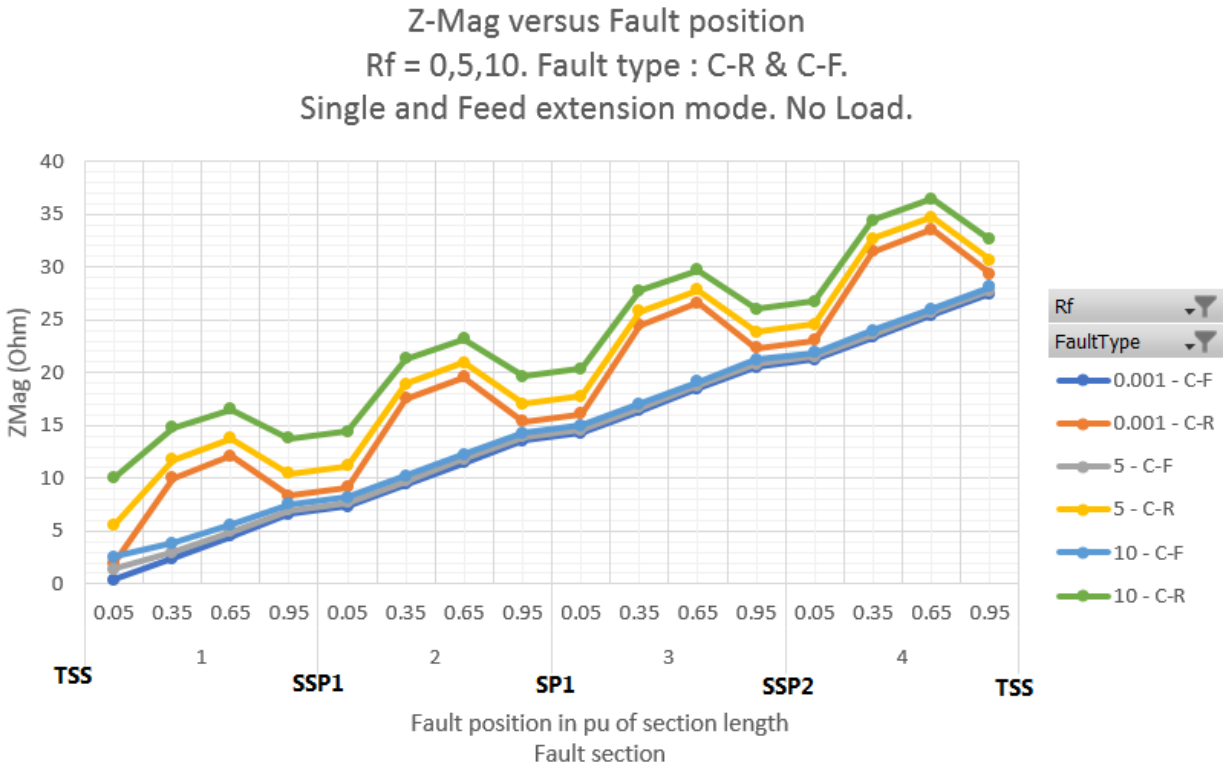
Fault Location Challenges (Effect of fault impedance)

- To get a fault location, fault resistance must be assumed to remove multiple solutions.

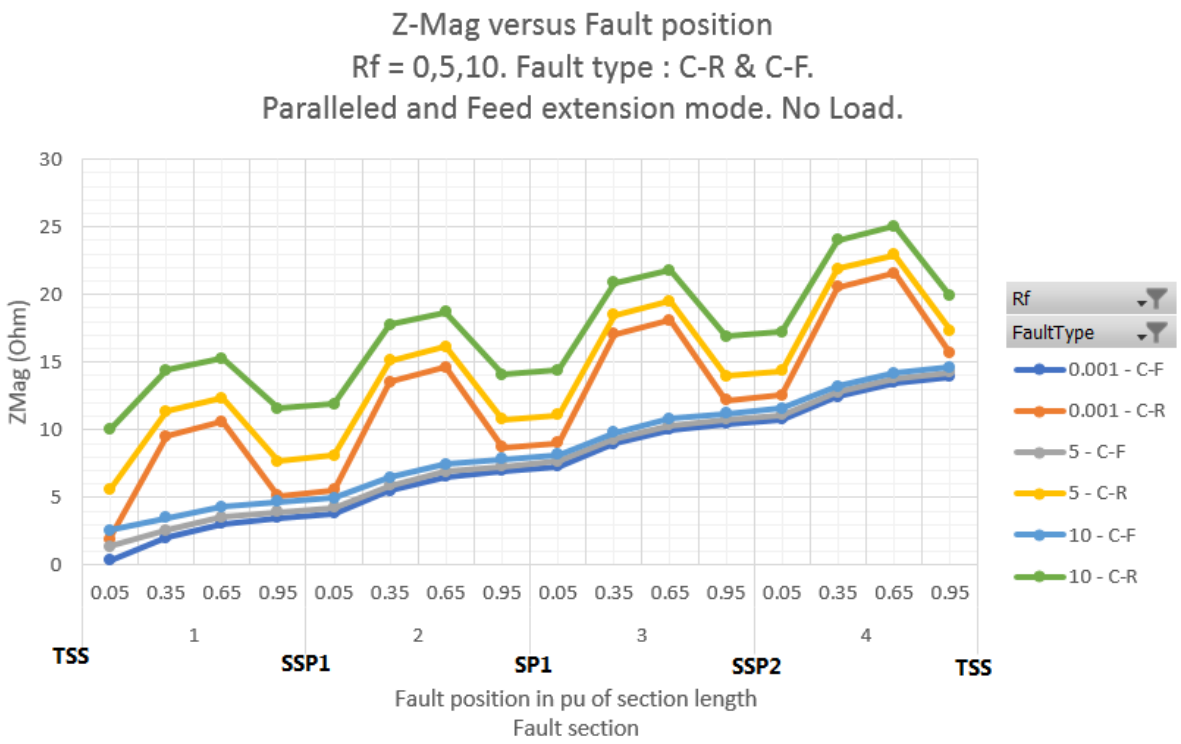


Observations from the results

- When the fault occurs between the catenary and rail or feeder and rail conductors, the magnitude of the impedance measured will be non-linear.
- For the catenary-to-feeder fault, the impedance characteristics are linear.



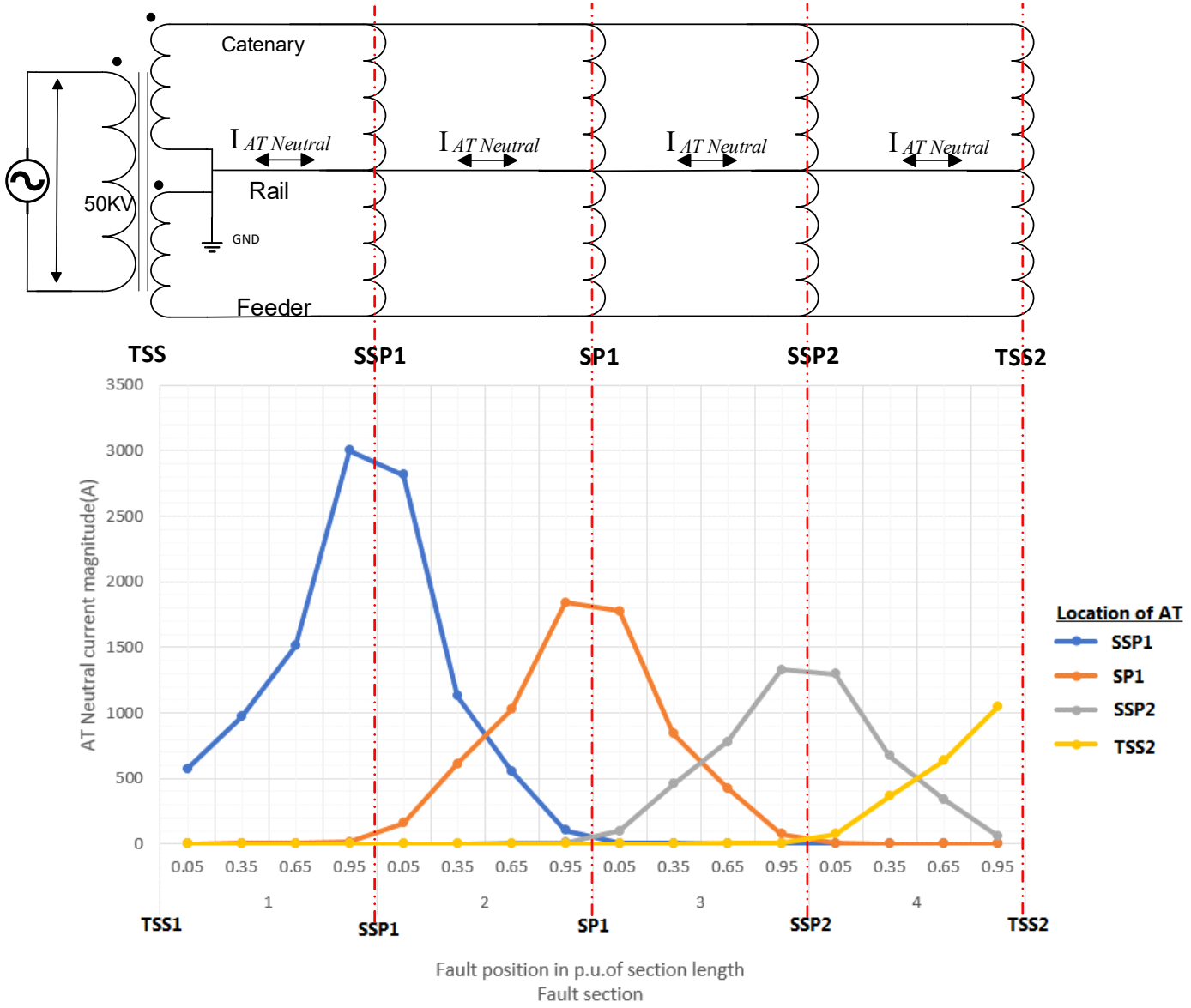
(a) Single track operation with feed extension mode



(b) Parallel track operation with feed extension mode

Solution to overcome fault location challenges

- To find the fault location for C-R and R-F faults, the magnitude of the neutral current in each section must be measured.
- From the measured neutral current, the faulted section and fault location can be calculated.



CONCLUSION

For finding the fault location

1. In the case of catenary to feeder faults, the fault loop impedance can be used because the impedance characteristics is linear.
2. In cases of either a catenary-to-rail fault or a rail-to-feeder fault, the neutral current of the autotransformer can be used because the impedance characteristics is non-linear.

REFERENCE

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