Yg-Yg Transformer Fails to Converge

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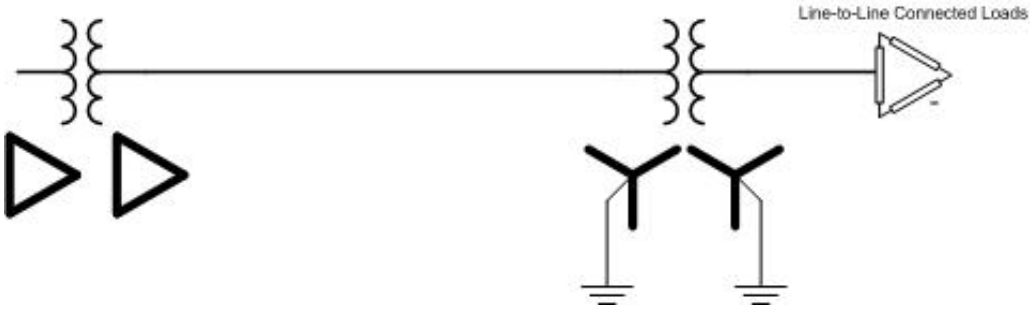
Question

I have the following circuit which is a delta feeder. I connected the single-phase loads Line-to-line as they are in real life but used a grounded Y-Y service transformer. I thought that a Yg-Yg transformer would always converge easily. Why does this circuit fail to converge for some loadings?



Answer

It is true that in many, if not most, cases using a solidly-grounded transformer or load with OpenDSS the solution will converge better. However, this is one case when it doesn't.

The reason is that there is nothing to stabilize the neutral point despite the fact that it is connected to ground. The source is delta and the load is connected in delta so there is nothing to force the voltage magnitudes on the Y windings. The zero-sequence network going back to the source is open. The shunt capacitance of the line provides some stabilization. Also, if you are using the default *PPM_antifloat* property of the OpenDSS transformer model, this will help stabilize the neutral by effectively connecting a small reactive load to each terminal of the transformer. This is probably why the solution converges for some loadings but not others.

I doubt that anyone would build a system like this intentionally, although I saw one once. Of course, it was a mistake and the system had voltage stability problems whenever the load became a little unbalanced. If this represents a real system, the primary winding is likely connected in delta. This will generally converge without difficulty. Y-Delta the other way will usually work as well because that is the way many generators are connected. The Delta winding forces the Y winding voltages into the proper 3-phase relationship.

If you really wanted to build a system like this, you would use a 3-winding Y-Y-D transformer or a 3-legged core Y-Y. The 3-legged core gives the transformer a "phantom" delta winding.

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