ECE 524: Homework #7

Problem 1: For the 345kV:69kV, 100MVA three phase transformer (wye grounded-wye grounded) has per unit leakage reactance of 10% with an X/R ratio of 12. There is also a total phase to ground capacitance of 7.5nF on the HV side. Model the transformer using the a transformer model and do the following.

A. Calculate the approximate worst case peak fault current for a fault at the low voltage terminals. What is the angle of inception compared to the voltage waveform (assume a cosine voltage source)? Assume a wye grounded source. Verify with simulation.

B. If the fault is interrupted by a circuit breaker on the HV side of the transformer calculate the frequency of the resulting oscillation. Estimate the approximate peak voltage across the circuit breaker contacts. Simulate the case to get a more accurate value.

C. Repeat parts A and B if the transformer is connected Δ-Y grounded (the source is unchanged). Show that the transformer has the correct ANSI phase shift. Just perform simulations.

Problem 2: Suppose a three phase 300MVA transformer has the following tap settings: 525kV:34.5kV:241.5kV

The transformer is connected Y-Δ-Y and is built from three single phase transformers. The test results for the three transformers were conducted with the H winding in the 525kV tap position, the X winding in the 241.5kV tap position, and the Y winding in the 34.5kV tap position):

\[
Z_{HX} := 9.46\% \quad \text{on a 300MVA base}
\]

\[
Z_{HY} := 21.18\% \quad \text{on a 30MVA base}
\]

\[
Z_{XY} := 15.92\% \quad \text{on an 30MVA base}
\]

Three Phase Excitation Losses (on 525kV): 918.75kW

Excitation Current: 2.56 (real and imaginary)--assume linear iron

Ignore winding resistance

A. Determine the appropriate transformer model parameters and implement this as a conventional transformer in your EMT program.

B. Verify that your transformer model is accurate (i.e. that it produces the correct voltages and exhibits the same test behavior).