HITEC UNIVERSITY

Heavy Industries Taxila Education City, Taxila Cantt-Pakistan

Department of Electrical Engineering

Lab project report

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Subject:

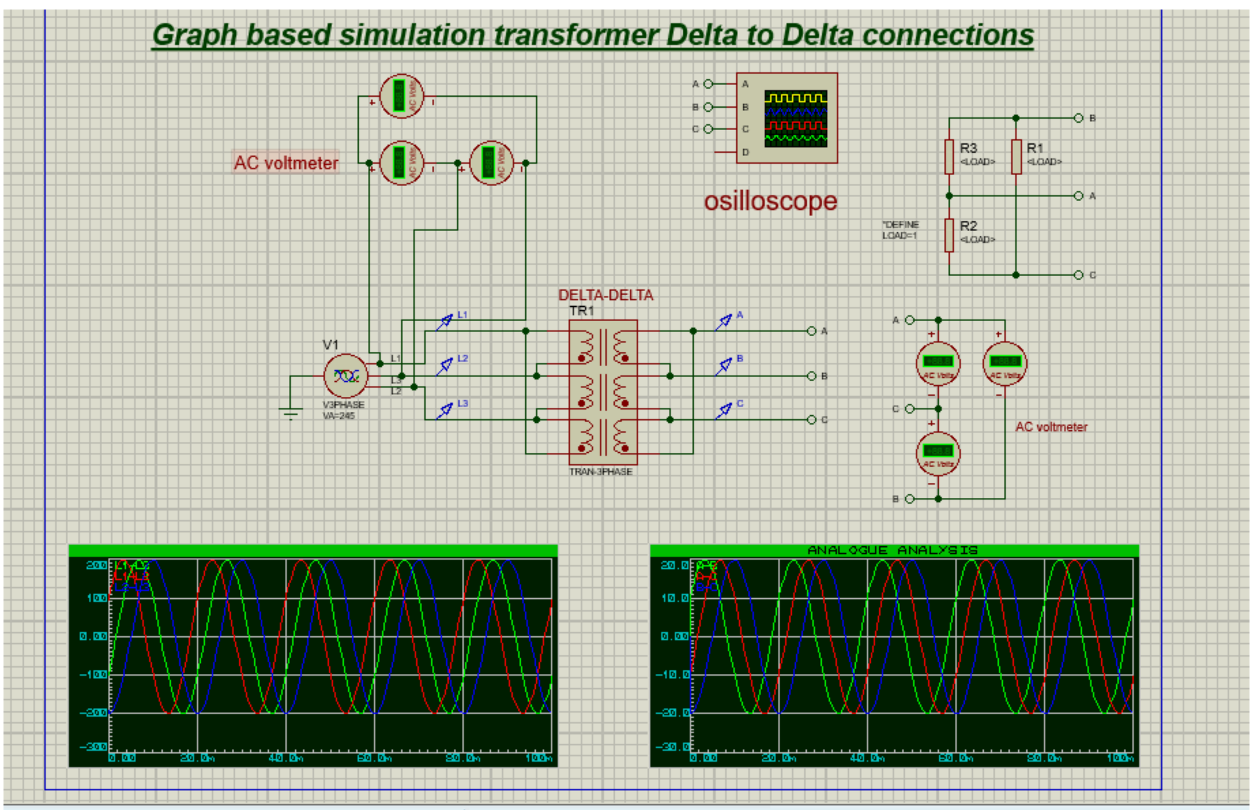
Electric Machines' ii lab

Graph based simulation transformer Delta to delta connection

- **Introduction:**

The Delta to Delta Transformer is a transformer in which secondary side and primary side of transformer is in delta connection. We can say that in this type of connection, both the three phase primary and secondary windings are connected in delta. Due to delta connection, phase voltage is same as line voltage hence winding have more number of turns. But phase current is (1/√3) times the line current. Hence the cross-section of the windings is very less. This makes the connection economical for low voltages transformers. Due to closed delta, third harmonic voltages are absent. The absence of star or neutral point proves to be advantageous in some cases.

- Wiring diagram



● *Working and explanations:*

Delta-connected transformers have the windings of three single-phase transformers connected in series with each other to form a closed circuit. The line conductors are connected to the unit where the two single-phase transformers meet. This configuration gets its name because in an electrical drawing it looks like a triangle (Greek symbol Δ for the letter “delta”). Many call it a high-leg system because the voltage from Line 2 to ground is higher than that of the other legs. For example, a 120V delta transformer will have a 208V leg.
In a delta transformer, the line current doesn't equal the phase current (as it does in a wye transformer). Because each line from a delta configured transformer is connected to two transformer phases, the line current from a 3-phase load will be greater than the phase current by the square root of 3. Note these formulas given in claculations.

● *Calculation:*

$I_{Line} = I_{Phase} \times \sqrt{3}$

$I_{Line} = VA_{Line} \div (E_{Line} \times \sqrt{3})$

$I_{Phase} = I_{Line} \div \sqrt{3}$

$I_{Phase} = VA_{Phase} \div E_{Phase}$

$I_{Line} = I_{Phase} \times \sqrt{3}$

$I_{Line} = VA_{Line} \div (E_{Line} \times \sqrt{3})$

$I_{Phase} = I_{Line} \div \sqrt{3}$

$I_{Phase} = VA_{Phase} \div E_{Phase}$

If we plug some numbers in, we can more clearly see the effects of the delta configuration on currents. Let's try this with a 240V, 36kVA, 3-phase load.

First, let's solve for the line current (total line power=36kVA).

$I_{Line} = VA_{Line} \div (E^{Line} \times \sqrt{3})$

$I_{Line} = 36{,}000VA \div (240V \times \sqrt{3})$

$I_{Line} = 87A$

Now, let's solve for the phase current (phase power=12kVA, per winding).

$I_{Phase} = VA_{Phase} \div E_{Phase}$

$I_{Phase} = 12{,}000VA \div 240V = 50A$

You can also find the line and phase currents using the other two formulas shown above.

$I_{Line} = I_{Phase} \times \sqrt{3}$

$I_{Line} = 50A \times 1.732 = 87A$

$I_{Phase} = I_{Line} \div \sqrt{3}$

$I_{Phase} = 87A \div 1.732 = 50A$

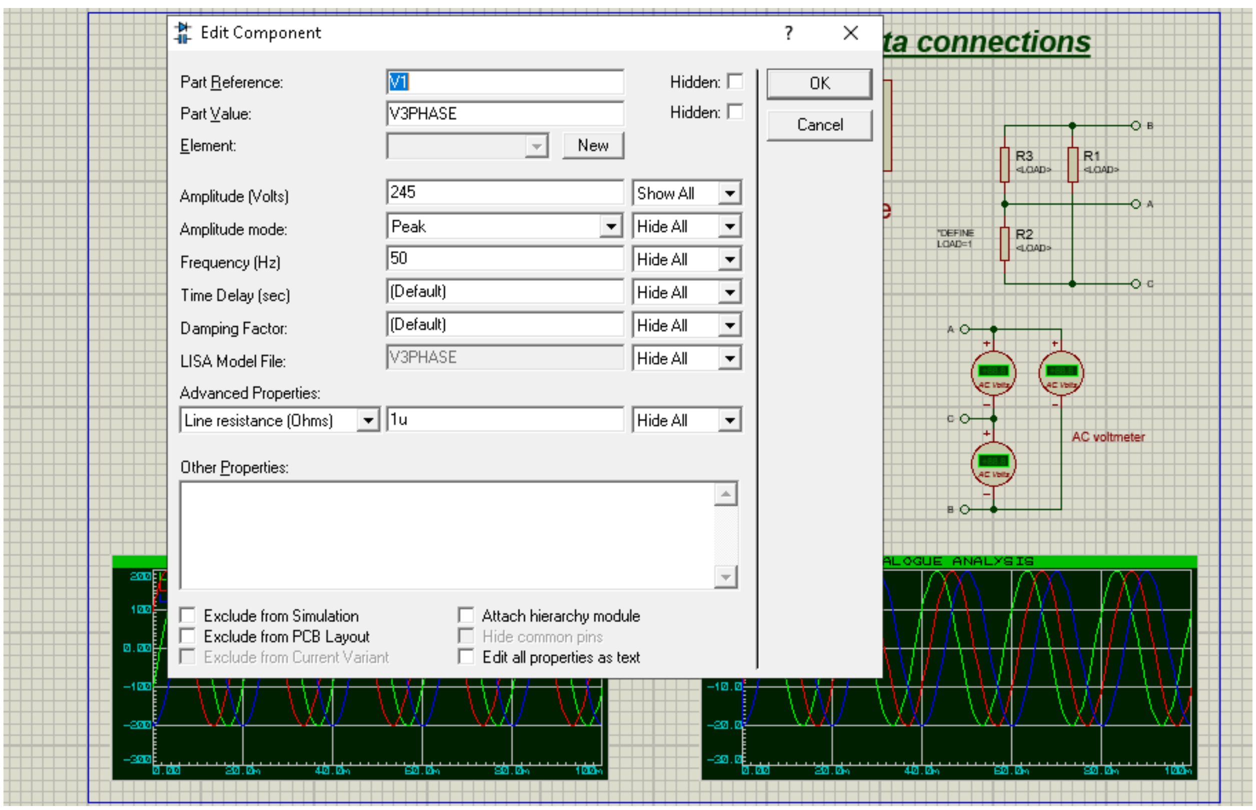
By using the formula: $I_{Line} = VA_{Line} \div (E_{Line} \times \sqrt{3})$.

the secondary line current for a 480V to 240/120V, 150kVA, 3-phase delta transformer.

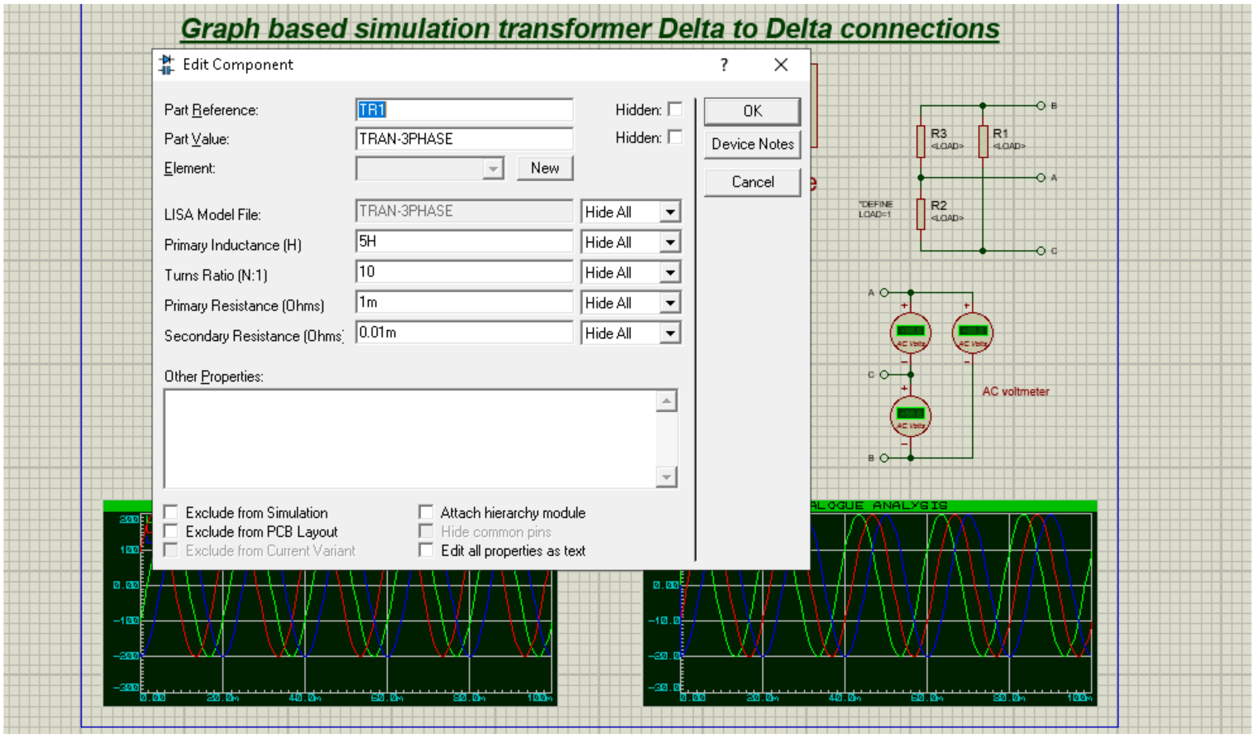
$$I_{Line}=VA_{Line}\div(E_{Line}\times\sqrt{3})$$

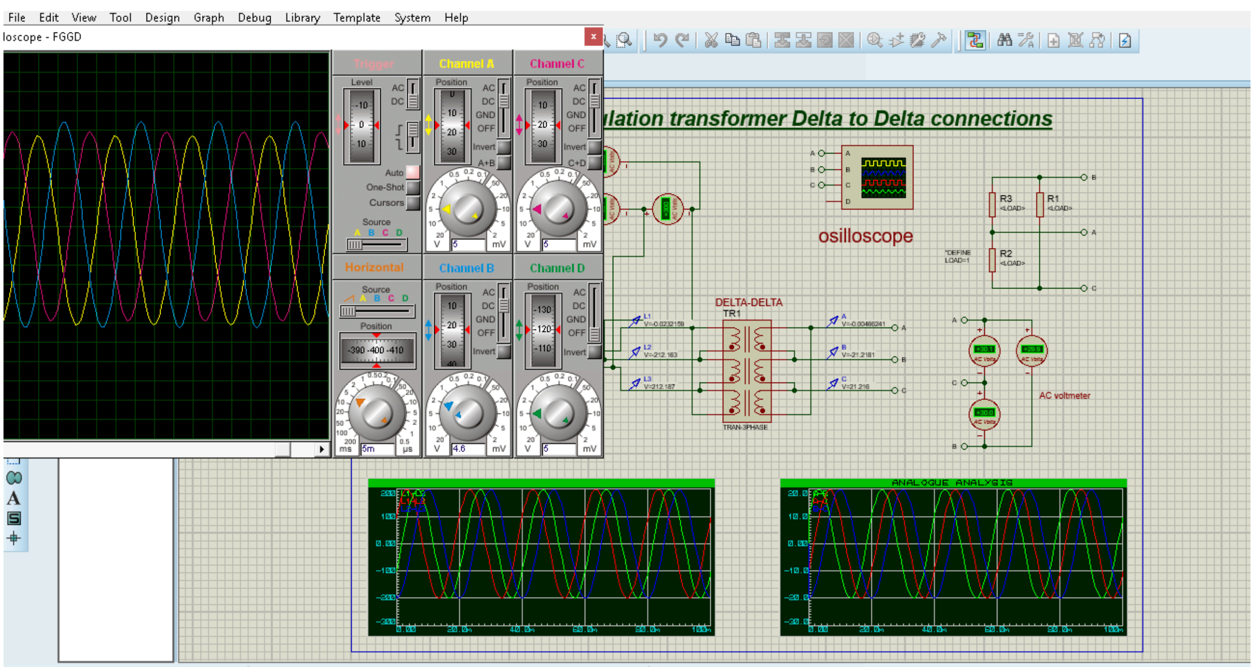
$$I_{Line}=150{,}000VA\div(240V\times1.732)=360A$$

Diagram circulations



● Results


Graph based simulation transformer Delta to Delta connections
Edit Component
Part Reference:
TR1
Hidden:
Part Value:
TRAN-3PHASE
Hidden:
Element:
New
OK
Device Notes
Cancel
LISA Model File:
TRAN-3PHASE
Hide All
Primary Inductance (H)
5H
Hide All
Turns Ratio (N:1)
10
Hide All
Primary Resistance (Ohms)
1m
Hide All
Secondary Resistance (Ohms)
0.01m
Hide All
Other Properties:
Exclude from Simulation
Exclude from PCB Layout
Exclude from Current Variant
Attach hierarchy module
Hide common pins
Edit all properties as text
R3
R1
R2
AC voltmeter


File Edit View Tool Design Graph Debug Library Template System Help
Trigger
Channel A
Channel C
Horizontal
Channel B
Channel D
lation transformer Delta to Delta connections
osilloscope
DELTA-DELTA
TR1
TRAN-3PHASE
R3
R1
R2
AC voltmeter
ANALOGUE ANALYSIS

● ***Conclusion:***

Reference:

Google,youtube,ieee journal