



HITEC UNIVERSITY

Heavy Industries Taxila Education City, Taxila Cantt-Pakistan

Department of Electrical Engineering

Lab project report

Submitted By:

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Submitted To:

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Subject:

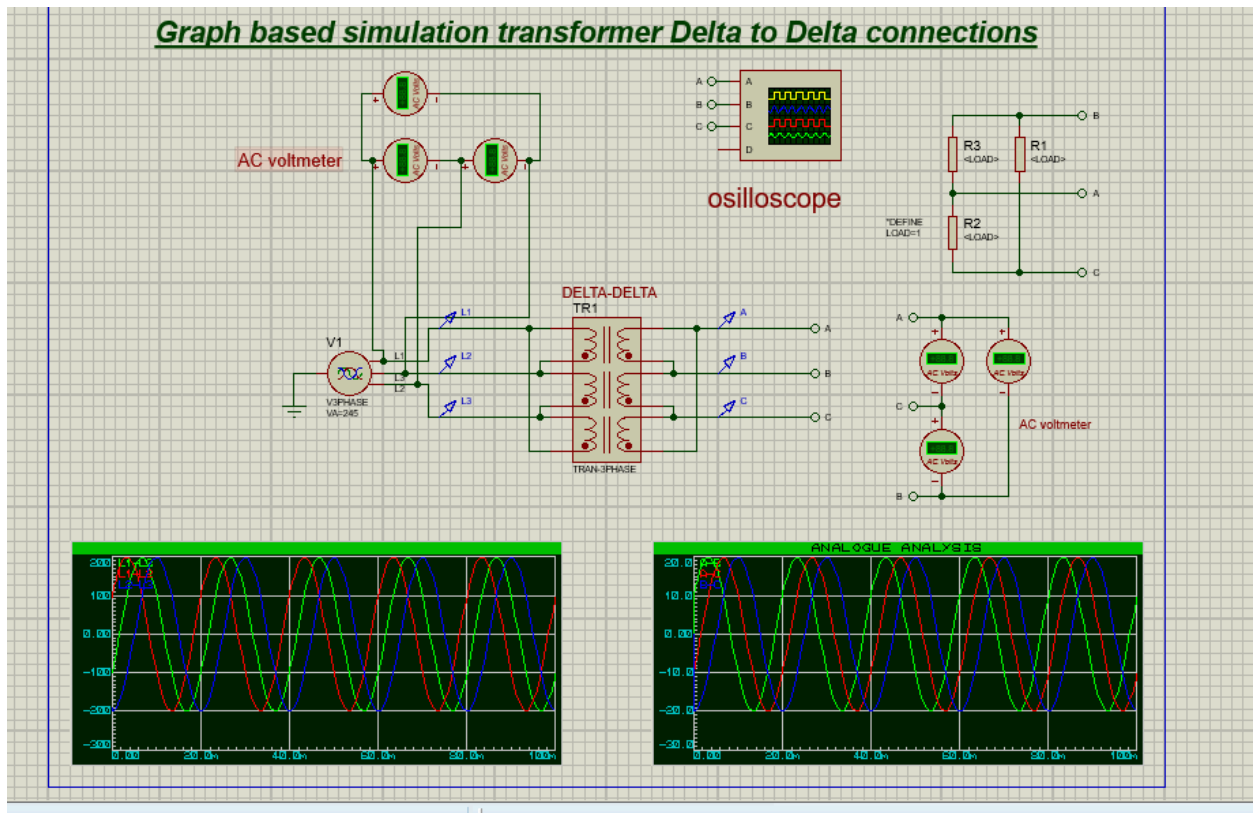
Electric Machines' ii lab

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 $(1/\sqrt{3})$ 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 calculations.

● Calculation:

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

$$I_{\text{Line}} = \text{VA}_{\text{Line}} \div (\text{E}_{\text{Line}} \times \sqrt{3})$$

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

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

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).

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

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

$$I_{\text{Line}} = 87A$$

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

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

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

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

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

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

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

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

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

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

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

$$I_{\text{Line}} = 150,000 \text{VA} \div (240 \text{V} \times 1.732) = 360 \text{A}$$

Diagram circulations

The image shows a screenshot of a circuit simulation software interface. A dialog box titled "Edit Component" is open, showing the configuration for a component named "V1". The dialog box includes fields for Part Reference (V1), Part Value (V3PHASE), Element, Amplitude (Volts) (245), Amplitude mode (Peak), Frequency (Hz) (50), Time Delay (sec) (Default), Damping Factor (Default), LISA Model File (V3PHASE), and Advanced Properties (Line resistance (Ohms) set to 1u). There are also checkboxes for "Exclude from Simulation", "Exclude from PCB Layout", "Exclude from Current Variant", "Attach hierarchy module", "Hide common pins", and "Edit all properties as text".

In the background, a circuit diagram is visible, showing three resistors labeled R1, R2, and R3, each with the value "<LOAD>". The resistors are connected to a three-phase AC source. Three AC voltmeters are connected across the resistors. The circuit is labeled "ta connections".

At the bottom of the screen, two waveform plots are shown, both labeled "LOGIC ANALYSIS". The left plot shows three sinusoidal waveforms with a peak-to-peak amplitude of approximately 300V. The right plot shows three sinusoidal waveforms with a peak-to-peak amplitude of approximately 10V.

● Results

Graph based simulation transformer Delta to Delta connections

Edit Component

Part Reference: Hidden:

Part Value: Hidden:

Element: New

LISA Model File: Hide All

Primary Inductance (H): Hide All

Turns Ratio (N:1): Hide All

Primary Resistance (Ohms): Hide All

Secondary Resistance (Ohms): Hide All

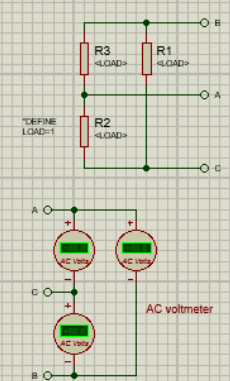
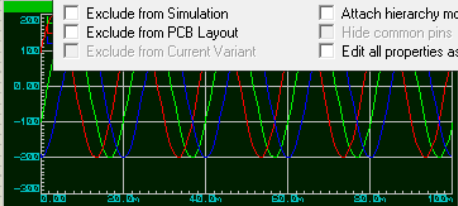
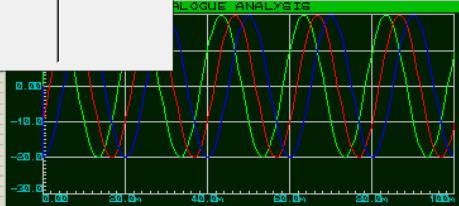
Other Properties:

Exclude from Simulation Attach hierarchy module

Exclude from PCB Layout Hide common pins

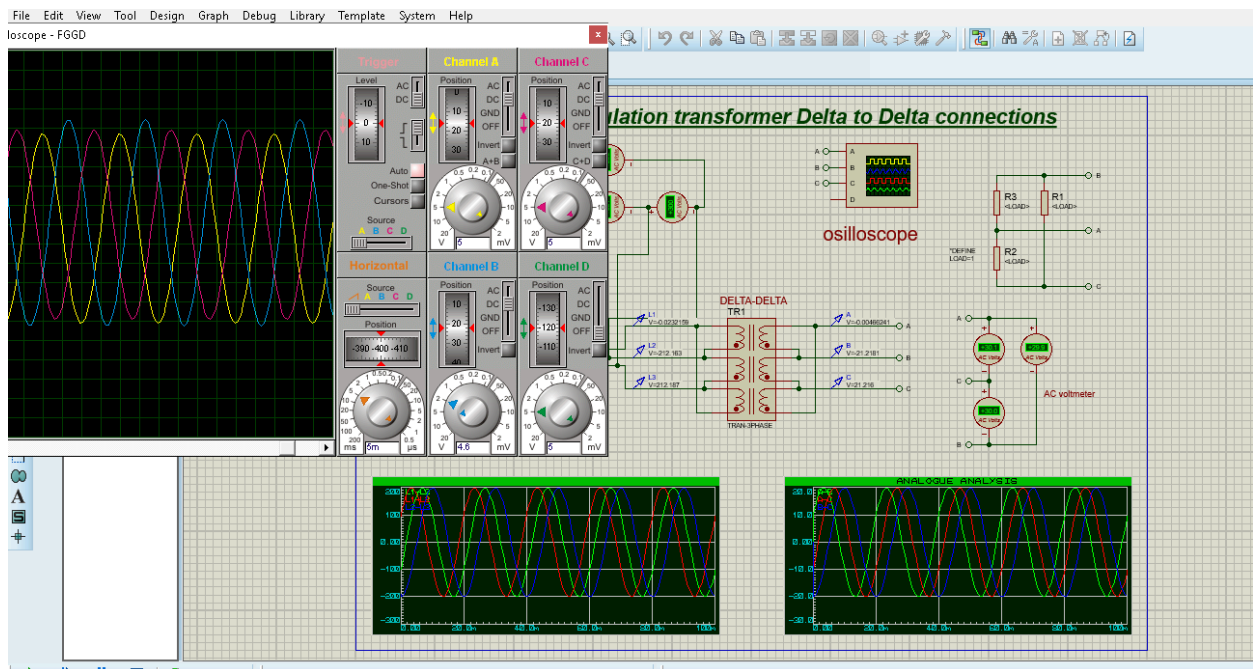
Exclude from Current Variant Edit all properties as text

OK Device Notes Cancel

File Edit View Tool Design Graph Debug Library Template System Help

oscope - FGDD



Simulation transformer Delta to Delta connections

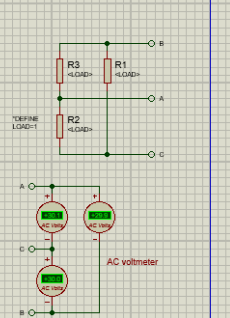
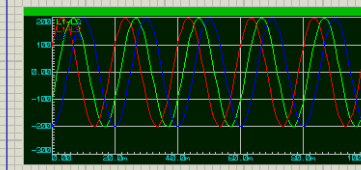
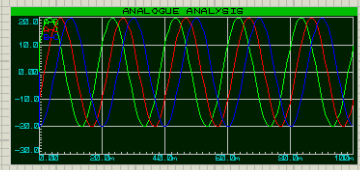
osilloscope

DELTA DELTA

TR1

TRAN-3PHASE

AC voltmeter

● **Conclusion:**

Reference:

Google,youtube,ieee journal