SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19EE605-PROTECTION AND SWITCHGEAR

III YEAR /VI SEMESTER EEE

RESONANT GROUNDING

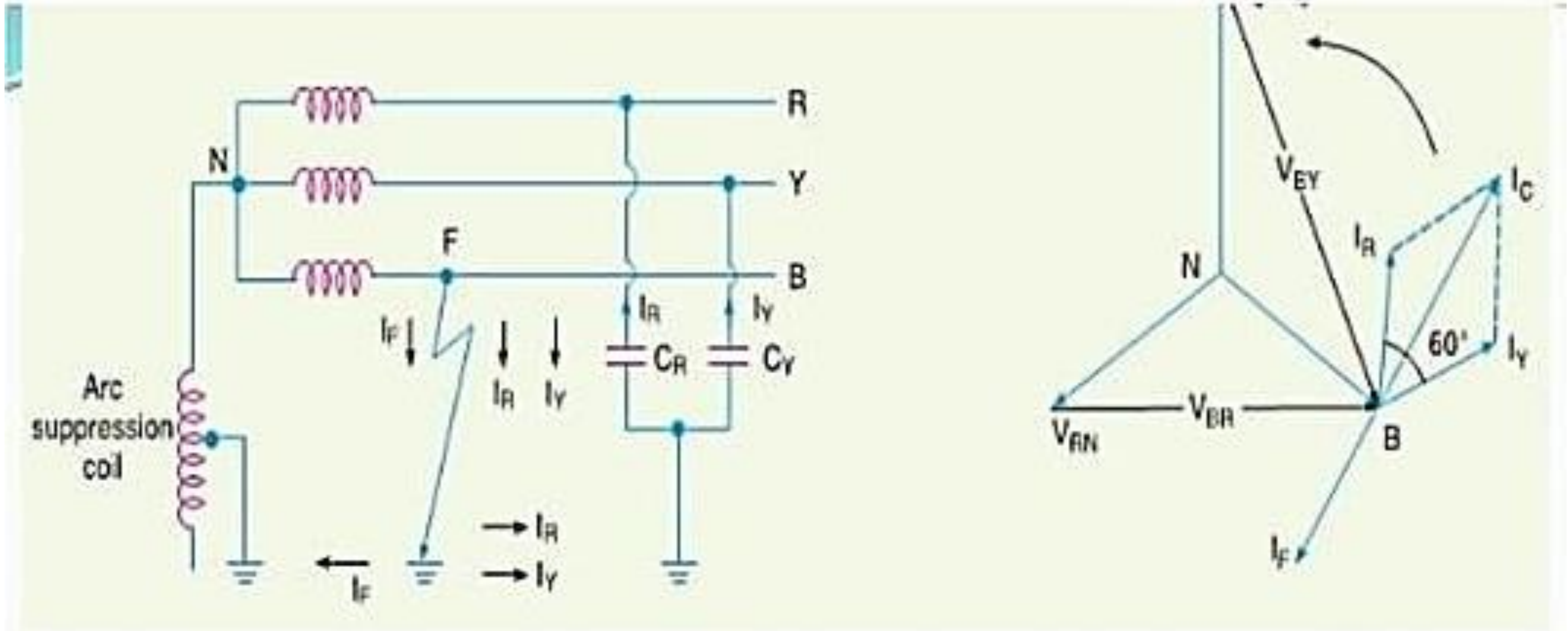
iv. PETERSON COIL
or
Arc Suppression Coil Grounding
or
Resonant Grounding

- If inductance L of appropriate value is connected in parallel with the capacitance of the system, the fault current I_F flowing through L will be in phase opposition to the capacitive current I_C of the system. If L is so adjusted that

$$I_L = I_C$$

then resultant current in the fault will be zero. This condition is known as Resonant Grounding.

When the value of L of arc suppression coil is such that the fault current I_F exactly balances the capacitive current I_C, it is called resonant grounding.



- An arc suppression coil (also called Peterson coil) is an iron-cored coil connected between the neutral and earth.
- The reactor is provided with tappings to change the inductance of the coil.
- By adjusting the tappings on the coil, the coil can be tuned with the capacitance of the system i.e. resonant grounding can be achieved.

Value of L for resonant grounding. For resonant grounding, the sy[stem behaves as an un]grounded neutral system. Therefore, full line voltage appears across capacitors C_R and C_Y.

$$\therefore \quad I_R = I_Y = \frac{\sqrt{3}V_{ph}}{X_C}$$

$$\therefore \quad I_C = \sqrt{3}\,I_R = \sqrt{3} \times \frac{\sqrt{3}V_{ph}}{X_C} = \frac{3V_{ph}}{X_C}$$

Here, X_C is the line to ground capacitive reactance.

Fault current, $$I_F = \frac{V_{ph}}{X_L}$$

Here, X_L is the inductive reactance of the arc suppression coil.

For resonant grounding, $I_L = I_C$.

or $$\frac{V_{ph}}{X_L} = \frac{3V_{ph}}{X_C}$$

or $$X_L = \frac{X_C}{3}$$

or $$\omega L = \frac{1}{3\omega C}$$

$$\therefore \quad L = \frac{1}{3\omega^2 C} \qquad \ldots(i)$$

Advantages. The Peterson coil grounding has the following advantages:

(*i*) The Peterson coil is completely effective in preventing any damage by an arcing ground.

(*ii*) The Peterson coil has the advantages of ungrounded neutral system.

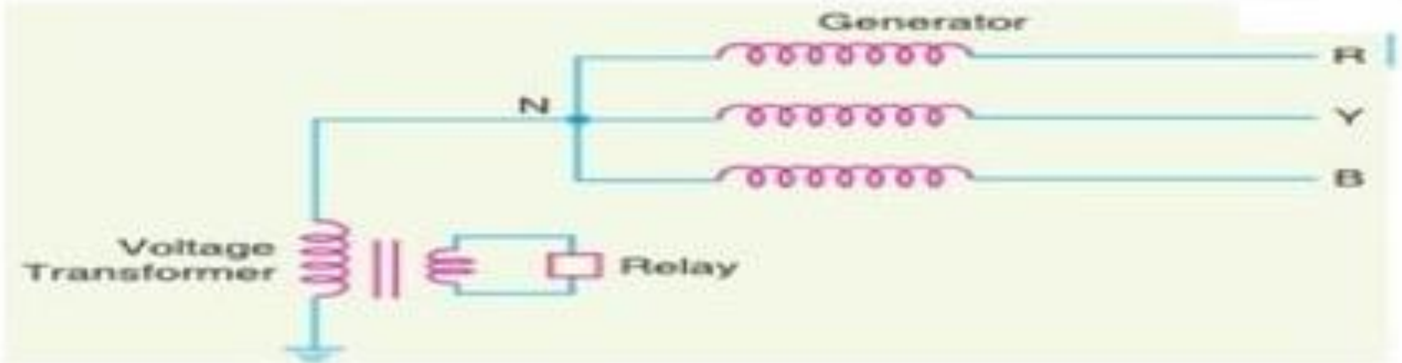
Disadvantages. The Peterson coil grounding has the following disadvantages :

(*i*) Due to varying operational conditions, the capacitance of the network changes from time to time. Therefore, inductance L of Peterson coil requires readjustment.

(*ii*) The lines should be transposed.

v. Voltage Transformer Earthing

- In this method of neutral earthing , the primary of a single-phase voltage transformer is connected between the neutral and the earth as shown in Fig
- A low resistor in series with a relay is connected across the secondary of the voltage transformer. The voltage transformer provides a high reactance in the neutral earthing circuit and operates virtually as an ungrounded neutral system.



Advantages. The following are the advantages of voltage transformer earthing :

(*i*) The transient overvoltages on the system due to switching and arcing grounds are reduced. It is because voltage transformer provides high reactance to the earth path.

(*ii*) This type of earthing has all the advantages of ungrounded neutral system.

(*iii*) Arcing grounds are eliminated.

Disadvantages. The following are the disadvantages of voltage transformer earthing :

(*i*) When earth fault occurs on any phase, the line voltage appears across line to earth capacitances. The system insulation will be overstressed.

(*ii*) The earthed neutral acts as a reflection point for the travelling waves through the machine winding. This may result in high voltage build up.

Applications. The use of this system of neutral earthing is normally confined to generator iipments which are directly connected to step-up power transformers.