(6)

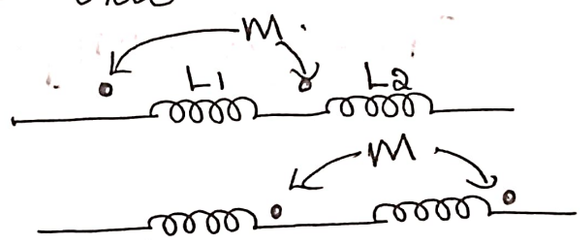
# Dot conversion in mutual Inductance

Dot conversion is used to find the sign for the mutally induced voltage in coupled circuits.

There are 4 Types of dot conversions

1) series aiding

Here the dot is placed either at the entry of the two mutally coupled coils or at the exit.

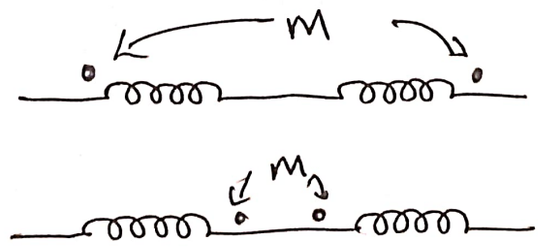



Equivalent inductance

$$L_{eq} = L_1 + L_2 + 2M.$$

2) series opposing

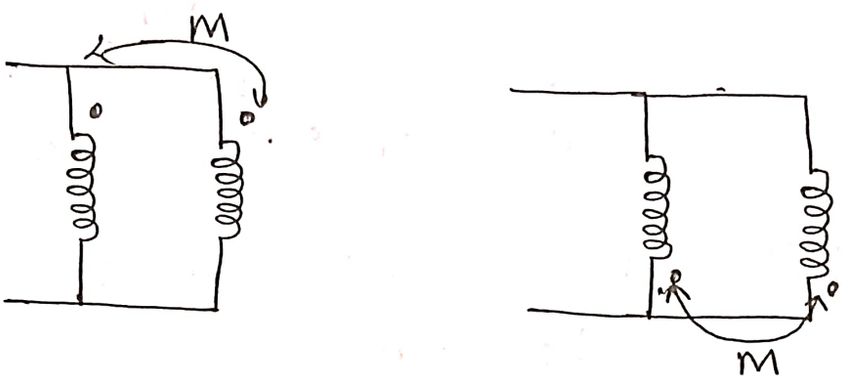
when dots are placed at entry of coil 1 and exit of coil 2 and vice versa.




$$L_{eq} = L_1 + L_2 - 2M.$$

## Parallel Aiding

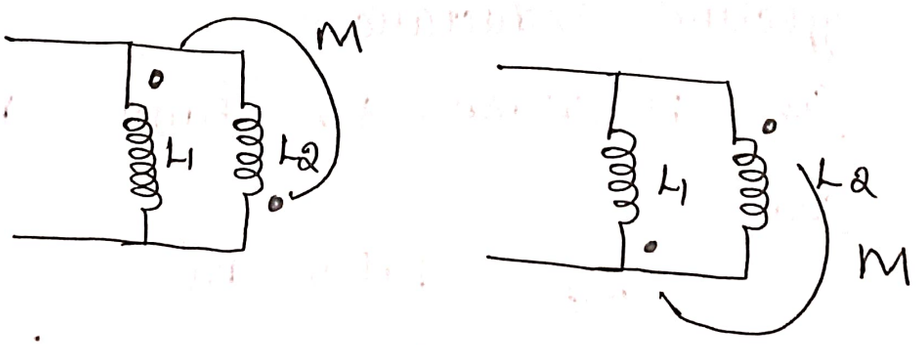
When the coils are connected in parallel and the dots are placed either at entry (or) at the exit of the coil.




$$L_{eq} = \frac{L_1 L_2 - M^2}{L_1 + L_2 - 2M}$$

Parallel opposing.

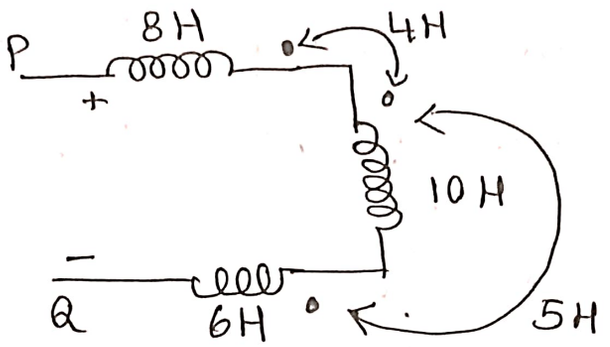
When the coils are connected parallely and the dots are placed at entry of coil and at exit, viceversa.




$$L_{eq} = \frac{L_1 L_2 - M^2}{L_1 + L_2 + 2M}.$$

(8)

1) Calculate the equivalent inductance between the terminals P and Q.




Given $L_1 = 8H$, $L_2 = 10H$, $L_3 = 6H$, $L_{12} = 4H$, $L_{23} = 5H$.

$$L_{eq} = L_1 + L_2 + L_3 - 2L_{12} + 2L_{23}$$
$$= 8 + 10 + 6 - (2 * 4) + 2(5)$$

$$\boxed{L_{eq} = 26H}$$

2) Two inductors with self inductance 75mH and 55mH connected in parallel aiding. The mutual inductance is given by 22.5mH. Find the effective inductance.

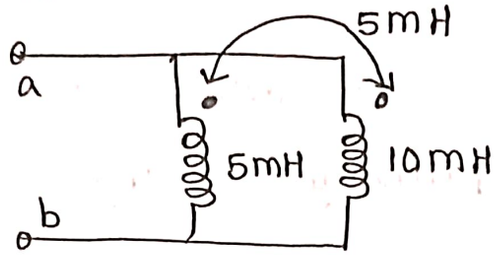
Gn $L_1 = 75mH$, $L_2 = 55mH$, $M = 22.5mH$.

Soln

$$L_{eff} = \frac{L_1L_2 - M^2}{L_1 + L_2 - 2M} = \frac{75 \times 55 - (22.5)^2}{75 + 55 - 2(22.5)}$$

$$\boxed{L_{eff} = 42.6\ mH}$$

3) Find the equivalent inductance of the circuit given




Soln $L_1 = 5mH$, $L_2 = 10mH$, $M = 5mH$

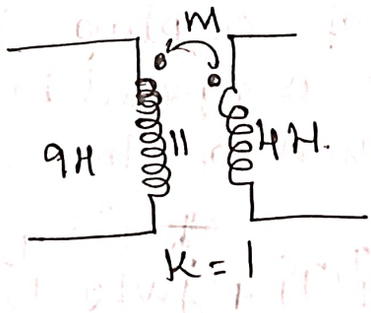
$$L_{eq} = \frac{L_1L_2 - M^2}{L_1 + L_2 - 2M} = \frac{5\times10^{-3}\times10\times10^{-3} - (5\times10^{-3})^2}{5\times10^{-3}+10\times10^{-3}-2\times5\times10^{-3}}$$

$$= \frac{50\times10^{-6} - 5^2\times10^{-6}}{25\times10^{-3}} = \frac{(50-25)10^{-6}}{25\times10^{-3}}$$

$$= \frac{10^{-6}[50\times10^{-3} - 5]}{5\times10^{-3}} = \frac{25\times10^{-3}}{25}$$

$$\boxed{L_{eq} = 5mH}$$

4) Find the mutual inductance of the circuit given




$$M = K\sqrt{L_1L_2}$$

$$= 1\sqrt{9\times4}$$

$$\boxed{M = 6H}$$