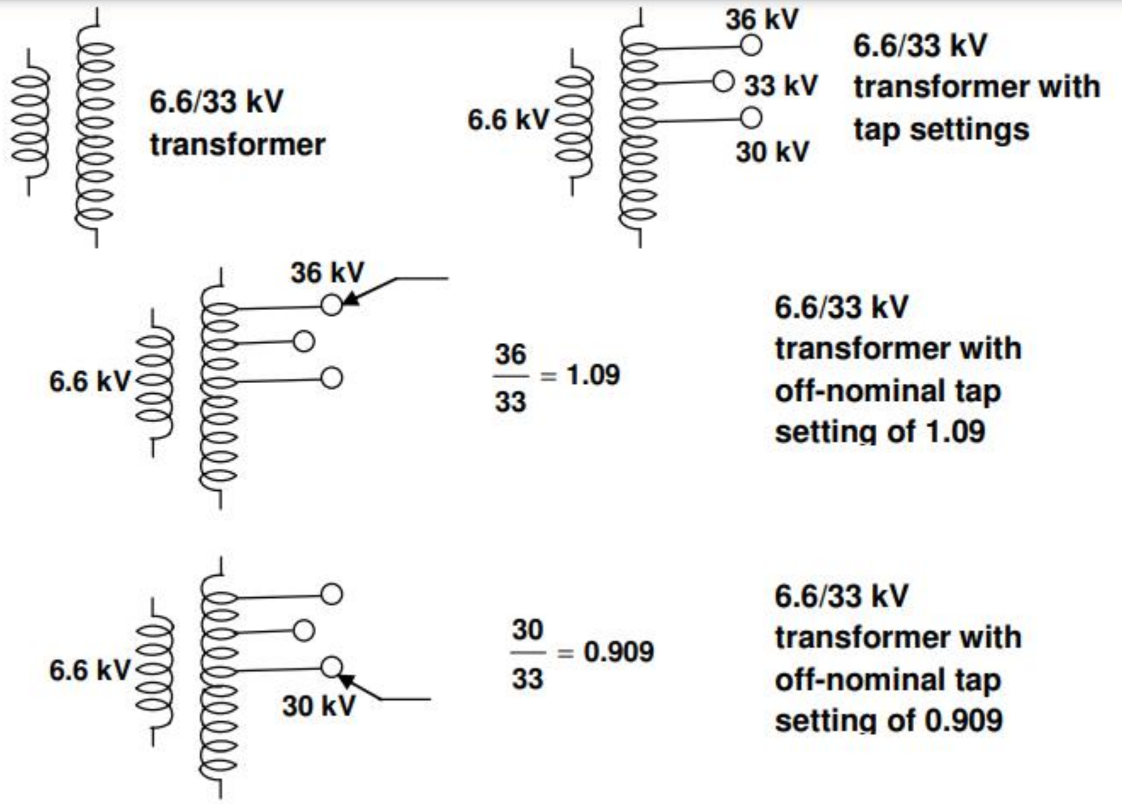
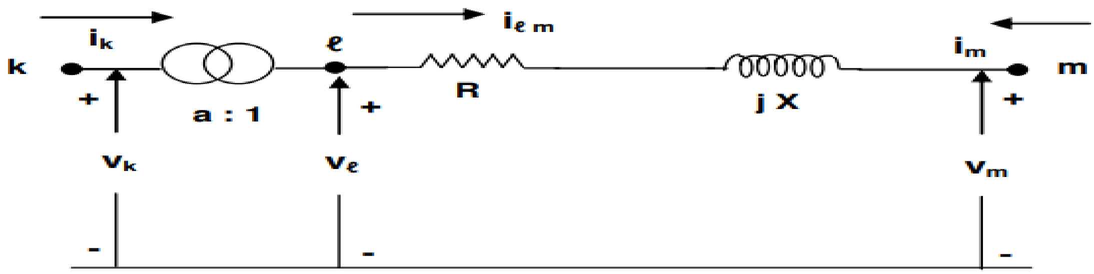
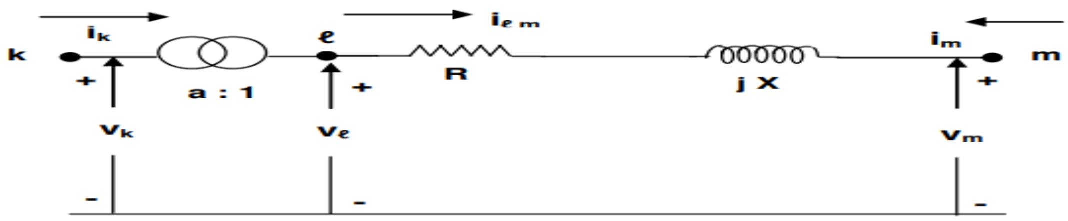
REPRESENTATION OF OFF-NOMINAL TAP SETTING TRANSFORMER



Transformers with off-nominal tap settings can be modelled as the series combination of auto-transformer with transformer impedance as shown in Figure. The two transformer terminals k and m are commonly designated as the tap side and impedance side bus respectively.

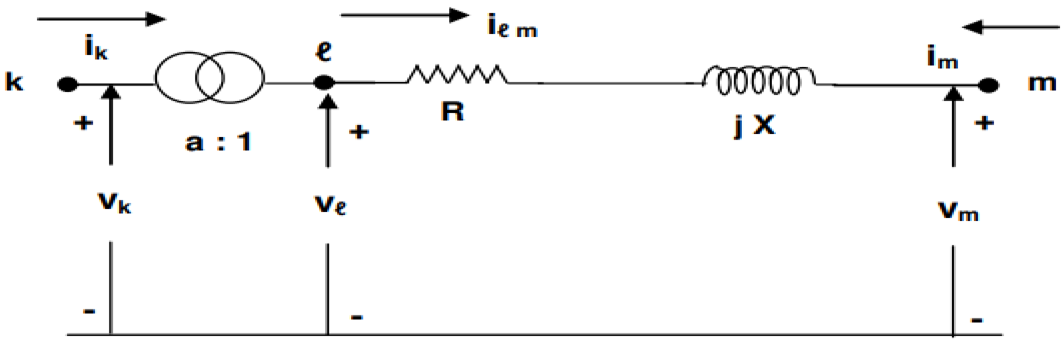
Equivalent circuit for an off-nominal tap setting transformer





The nodal equations of the two port circuit of Fig. can be derived by first expressing the current flows i_{lm} and i_m at each end of the series branch R + jX in terms of the terminal voltages v_l and v_m. Denoting the admittance of this branch -m by y, the terminal current injection will be given by

$$\begin{bmatrix} i_{\ell m} \\ i_m \end{bmatrix} = \begin{bmatrix} y & -y \\ -y & y \end{bmatrix} \begin{bmatrix} v_\ell \\ v_m \end{bmatrix}$$



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Knowing that vk / v = a and im / ik = a, substituting for im and vl as

$i_{\ell m} = a\, i_k;\quad v_\ell = v_k / a$ **we get** $\begin{bmatrix} a\, i_k \\ i_m \end{bmatrix} = \begin{bmatrix} y & -y \\ -y & y \end{bmatrix} \begin{bmatrix} v_k/a \\ v_m \end{bmatrix}$

The final form will be obtained as

$$\begin{bmatrix} i_{\ell m} \\ i_m \end{bmatrix} = \begin{bmatrix} y & -y \\ -y & y \end{bmatrix} \begin{bmatrix} v_\ell \\ v_m \end{bmatrix}$$

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The final form will be obtained as

$$\begin{bmatrix} i_k \\ i_m \end{bmatrix} = \begin{bmatrix} \frac{y}{a^2} & -\frac{y}{a} \\ -\frac{y}{a} & y \end{bmatrix} \begin{bmatrix} v_k \\ v_m \end{bmatrix}$$