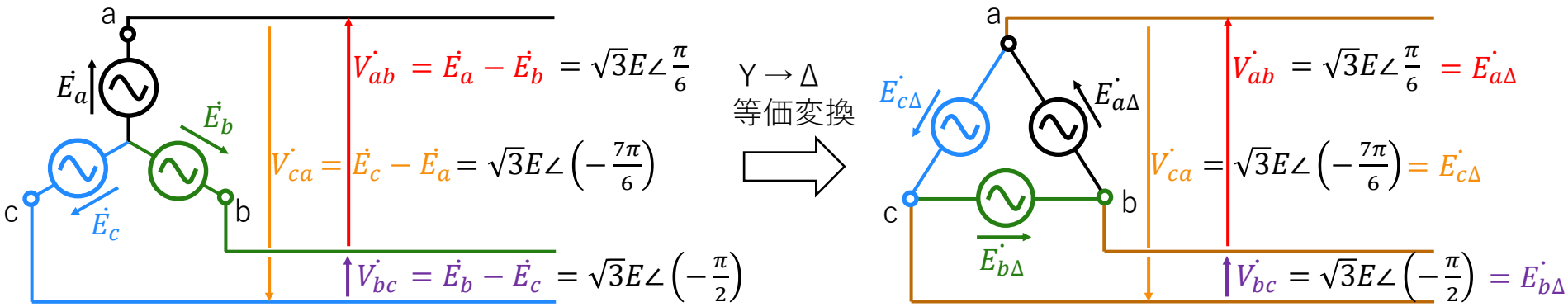
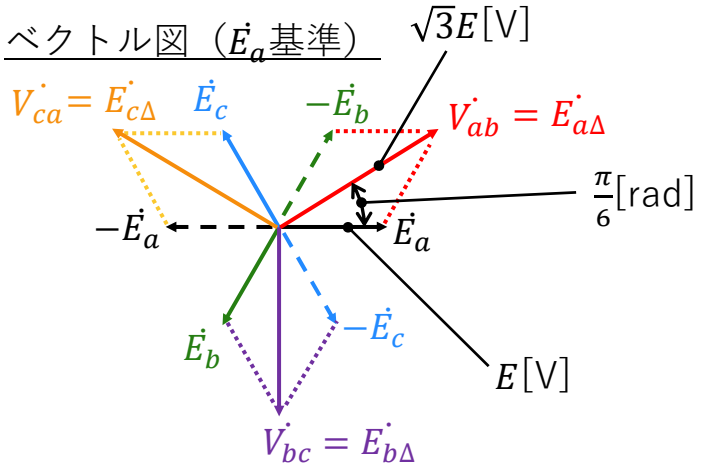
三相交流（８）　《三相交流電源のＹ→Δ変換》



Ｙ結線の相電圧

$$\begin{cases} \dot{E}_a = E\angle 0 \\ \dot{E}_b = E\angle\left(-\frac{2\pi}{3}\right) \\ \dot{E}_c = E\angle\left(-\frac{4\pi}{3}\right) \end{cases}$$

ベクトル図（$\dot{E}_a$基準）

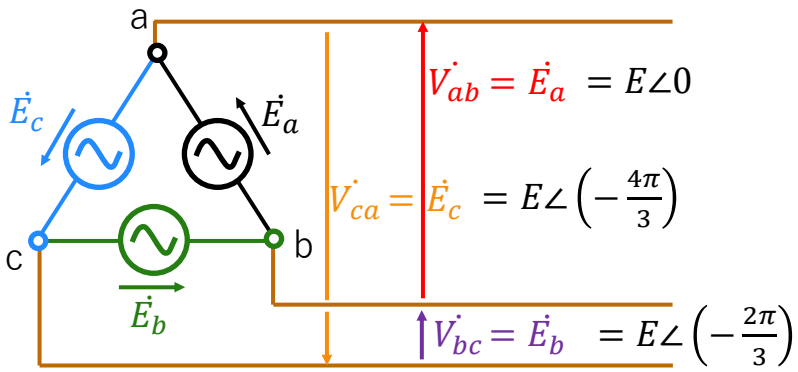


Δ結線に変換した相電圧

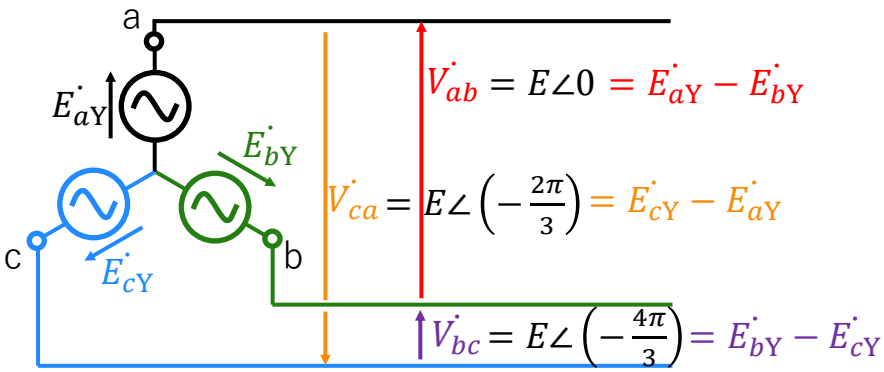
$$\begin{cases} \dot{E}_{a\Delta} = \sqrt{3}E\angle\frac{\pi}{6} \\ \dot{E}_{b\Delta} = \sqrt{3}E\angle\left(-\frac{\pi}{2}\right) \\ \dot{E}_{c\Delta} = \sqrt{3}E\angle\left(-\frac{7\pi}{6}\right) \end{cases}$$

Ｙ結線からΔ結線に変換した相電圧は、
大きさが$\sqrt{3}$倍となり、位相が$\frac{\pi}{6}$[rad]進む

三相交流（９）　《三相交流電源のΔ→Ｙ変換》



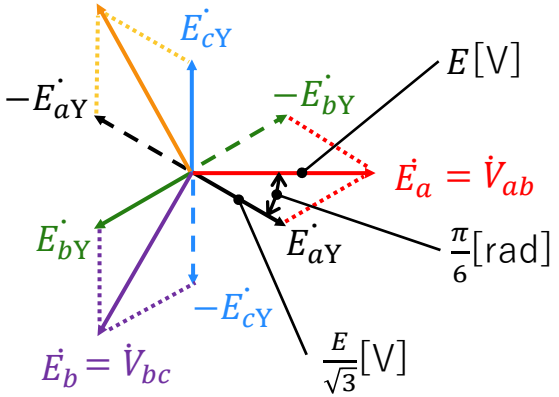
Δ→Ｙ
等価変換



Δ結線の相電圧

$$\begin{cases}\dot{E}_a=E\angle 0\\ \dot{E}_b=E\angle\left(-\frac{2\pi}{3}\right)\\ \dot{E}_c=E\angle\left(-\frac{4\pi}{3}\right)\end{cases}$$

$\dot{E}_c=\dot{V}_{ca}$　ベクトル図（$\dot{E}_a$基準）

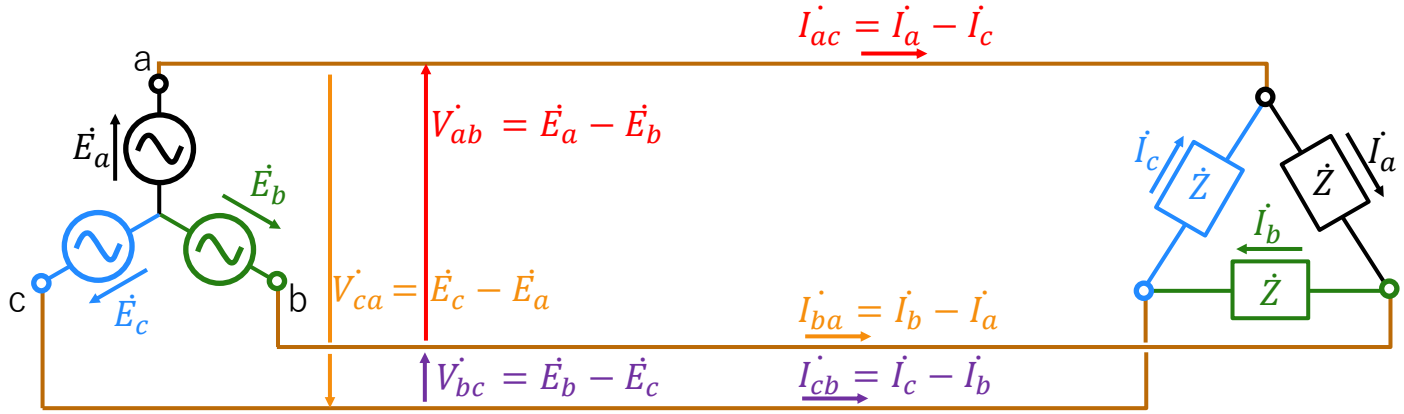


Ｙ結線に変換した相電圧

$$\begin{cases}\dot{E}_{aY}=\frac{E}{\sqrt{3}}\angle\left(-\frac{\pi}{6}\right)\\ \dot{E}_{bY}=\frac{E}{\sqrt{3}}\angle\left(-\frac{5\pi}{6}\right)\\ \dot{E}_{cY}=\frac{E}{\sqrt{3}}\angle\left(-\frac{3\pi}{2}\right)\end{cases}$$

Δ結線からＹ結線に変換した相電圧は、
大きさが$\frac{1}{\sqrt{3}}$倍となり、位相が$\frac{\pi}{6}$[rad]遅れる

三相交流（10）　《Y電源－Δ負荷 接続》



$|\dot{V}_{ab}| = |\dot{V}_{bc}| = |\dot{V}_{ca}| = V$ [V]

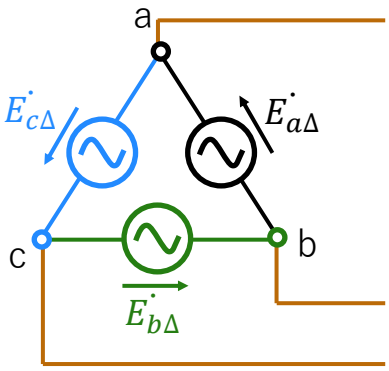
$|\dot{E}_a| = |\dot{E}_b| = |\dot{E}_c| = E$ [V]

$E = \dfrac{V}{\sqrt{3}}$ [V]

$|\dot{I}_{ac}| = |\dot{I}_{ba}| = |\dot{I}_{cb}| = I$ [A]

$|\dot{I}_a| = |\dot{I}_b| = |\dot{I}_c| = \dfrac{I}{\sqrt{3}}$ [A]

Δ→Y 等価変換



Δ結線に変換した相電圧

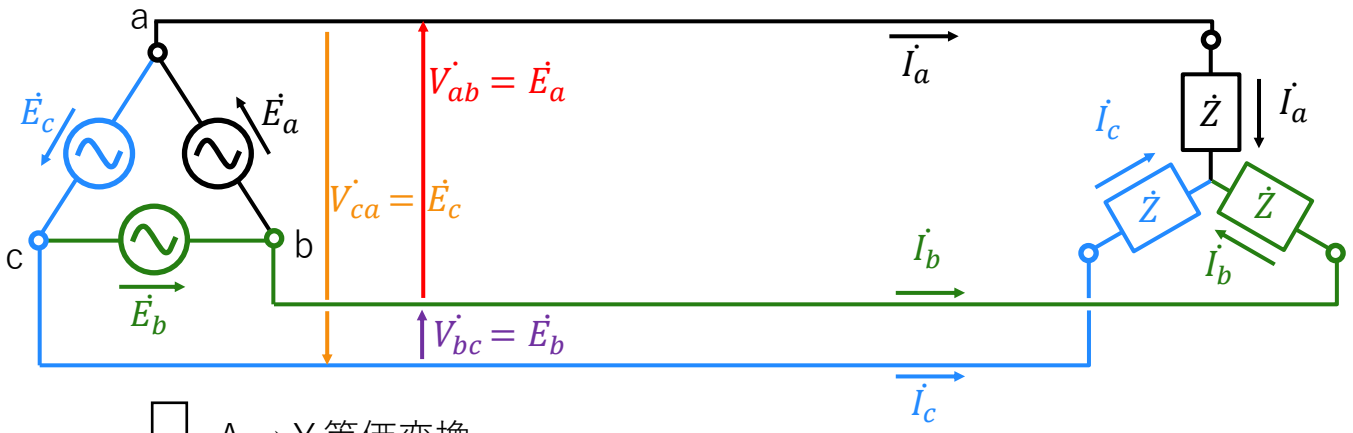
$$\begin{cases} \dot{E}_{a\Delta} = \sqrt{3}E\angle\dfrac{\pi}{6} = V\angle\dfrac{\pi}{6} \\ \dot{E}_{b\Delta} = \sqrt{3}E\angle\left(-\dfrac{\pi}{2}\right) = V\angle\left(-\dfrac{\pi}{2}\right) \\ \dot{E}_{c\Delta} = \sqrt{3}E\angle\left(-\dfrac{7\pi}{6}\right) = V\angle\left(-\dfrac{7\pi}{6}\right) \end{cases}$$

【a相等価単相回路】

有効電力[W]：　$P = |\dot{E}_{a\Delta}||\dot{I}_a|\cos\theta = \dfrac{VI}{\sqrt{3}}\cos\theta$

三相分だと3倍なので　$P = \sqrt{3}VI\cos\theta$

三相交流（11）　《Δ電源－Y負荷 接続》



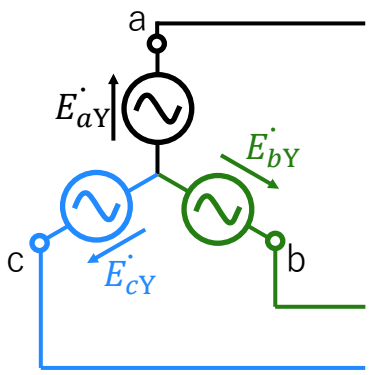
$|\dot{V}_{ab}| = |\dot{V}_{bc}| = |\dot{V}_{ca}| = V$ [V]

$|\dot{E}_a| = |\dot{E}_b| = |\dot{E}_c| = E$ [V]

$E = V$ [V]

$|\dot{I}_a| = |\dot{I}_b| = |\dot{I}_c| = I$ [A]

Δ → Y 等価変換



Y結線に変換した相電圧

$$\begin{cases} \dot{E}_{aY} = \frac{E}{\sqrt{3}}\angle\left(-\frac{\pi}{6}\right) = \frac{V}{\sqrt{3}}\angle\left(-\frac{\pi}{6}\right) \\ \dot{E}_{bY} = \frac{E}{\sqrt{3}}\angle\left(-\frac{5\pi}{6}\right) = \frac{V}{\sqrt{3}}\angle\left(-\frac{5\pi}{6}\right) \\ \dot{E}_{cY} = \frac{E}{\sqrt{3}}\angle\left(-\frac{3\pi}{2}\right) = \frac{V}{\sqrt{3}}\angle\left(-\frac{3\pi}{2}\right) \end{cases}$$

【a相等価単相回路】

有効電力[W]：　$P = |\dot{E}_{aY}||\dot{I}_a|\cos\theta = \frac{VI}{\sqrt{3}}\cos\theta$

三相分だと3倍なので　$P = \sqrt{3}VI\cos\theta$