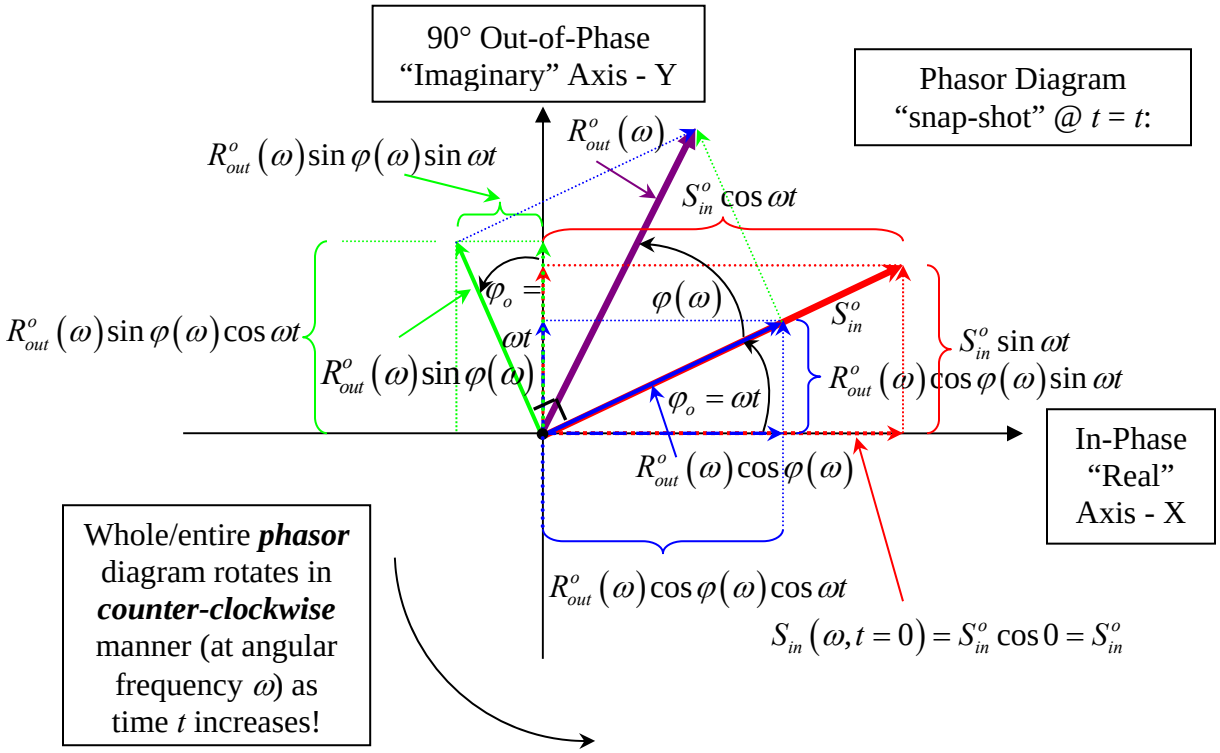
As time t increases, the entire phasor diagram rotates counter-clockwise in the complex plane, with angular frequency ω as shown in the figure below, for a "snapshot-in-time" at time $t = t$.

The entire $t = t$ phasor diagram below is rotated CCW relative to the above $t = 0$ phasor diagram by an angle $\varphi_o = \omega t$:



If we write out/expand:

$$\tilde{R}_{out}(t) = R^o_{out}(\omega)\cos\left(\omega t + \varphi(\omega)\right) + iR^o_{out}(\omega)\sin\left(\omega t + \varphi(\omega)\right) = R^o_{out}(\omega)e^{i\left(\omega t + \varphi(\omega)\right)}$$

$$= \underbrace{R^o_{out}(\omega)\left\{\cos\omega t\cos\varphi(\omega) - \sin\omega t\sin\varphi(\omega)\right\}}_{\equiv \mathrm{Re}\left\{\tilde{R}_{out}(t)\right\}} + i\underbrace{R^o_{out}(\omega)\left\{\sin\omega t\cos\varphi(\omega) + \cos\omega t\sin\varphi(\omega)\right\}}_{\equiv \mathrm{Im}\left\{\tilde{R}_{out}(t)\right\}}$$

$$= \mathrm{Re}\left\{\tilde{R}_{out}(t)\right\} + i\,\mathrm{Im}\left\{\tilde{R}_{out}(t)\right\}$$

We can equivalently write this expression in ***matrix notation*** as follows:

$$\begin{pmatrix} \mathrm{Re}\left\{\tilde{R}_{out}(t)\right\} \\ \mathrm{Im}\left\{\tilde{R}_{out}(t)\right\} \end{pmatrix} = \begin{pmatrix} R^o_{out}(\omega)\left\{\cos\omega t\cos\varphi(\omega) - \sin\omega t\sin\varphi(\omega)\right\} \\ R^o_{out}(\omega)\left\{\sin\omega t\cos\varphi(\omega) + \cos\omega t\sin\varphi(\omega)\right\} \end{pmatrix}$$

$$= \begin{pmatrix} \cos\omega t & -\sin\omega t \\ \sin\omega t & \cos\omega t \end{pmatrix}\begin{pmatrix} R^o_{out}(\omega)\cos\varphi(\omega) \\ R^o_{out}(\omega)\sin\varphi(\omega) \end{pmatrix}$$