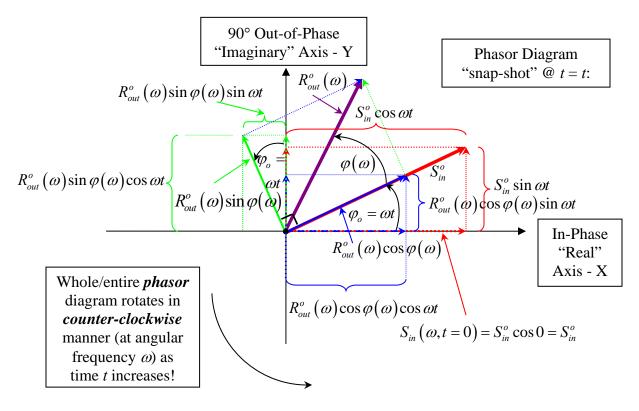
As time *t* increases, the entire phasor diagram rotates counter-clockwise in the complex plane, with angular frequency  $\omega$  as shown in the figure below, for a "snapshot-in-time" at time *t* = *t*.

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:

$$\begin{split} \tilde{R}_{out}\left(t\right) &= R_{out}^{o}\left(\omega\right) \cos\left(\omega t + \varphi\left(\omega\right)\right) + iR_{out}^{o}\left(\omega\right) \sin\left(\omega t + \varphi\left(\omega\right)\right) = R_{out}^{o}\left(\omega\right) e^{i\left(\omega t + \varphi\left(\omega\right)\right)} \\ &= \underbrace{R_{out}^{o}\left(\omega\right) \left\{\cos\omega t\cos\varphi\left(\omega\right) - \sin\omega t\sin\varphi\left(\omega\right)\right\}}_{&= \operatorname{Re}\left\{\tilde{R}_{out}\left(t\right)\right\}} + i\underbrace{R_{out}^{o}\left(\omega\right) \left\{\sin\omega t\cos\varphi\left(\omega\right) + \cos\omega t\sin\varphi\left(\omega\right)\right\}}_{&= \operatorname{Im}\left\{\tilde{R}_{out}\left(t\right)\right\}} \\ &= \operatorname{Re}\left\{\tilde{R}_{out}\left(t\right)\right\} + i\operatorname{Im}\left\{\tilde{R}_{out}\left(t\right)\right\} \end{split}$$

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

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

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