

Summary of Various Frequency-Domain Sound Field Physical Quantities:
Complex scalar pressure:

$$\tilde{p}(\vec{r}, \omega) = p_r(\vec{r}, \omega) + ip_i(\vec{r}, \omega) = |\tilde{p}(\vec{r})| e^{i\phi_p(\vec{r}, \omega)}$$

Complex 3-D vector particle displacement:

$$\begin{aligned} \vec{\xi}(\vec{r}, \omega) &= \vec{\xi}_r(\vec{r}, \omega) + i\vec{\xi}_i(\vec{r}, \omega) \\ &= \left[\xi_{r_x}(\vec{r}, \omega) + i\xi_{i_x}(\vec{r}, \omega) \right] \hat{x} + \left[\xi_{r_y}(\vec{r}, \omega) + i\xi_{i_y}(\vec{r}, \omega) \right] \hat{y} + \left[\xi_{r_z}(\vec{r}, \omega) + i\xi_{i_z}(\vec{r}, \omega) \right] \hat{z} \\ &= \left| \tilde{\xi}_x(\vec{r}, \omega) \right| e^{i\phi_{\xi_x}(\vec{r}, \omega)} \hat{x} + \left| \tilde{\xi}_y(\vec{r}, \omega) \right| e^{i\phi_{\xi_y}(\vec{r}, \omega)} \hat{y} + \left| \tilde{\xi}_z(\vec{r}, \omega) \right| e^{i\phi_{\xi_z}(\vec{r}, \omega)} \hat{z} \end{aligned}$$

Complex 3-D vector particle velocity:

$$\begin{aligned} \vec{u}(\vec{r}, \omega) &= \vec{u}_r(\vec{r}, \omega) + i\vec{u}_i(\vec{r}, \omega) \\ &= \left[u_{r_x}(\vec{r}, \omega) + iu_{i_x}(\vec{r}, \omega) \right] \hat{x} + \left[u_{r_y}(\vec{r}, \omega) + iu_{i_y}(\vec{r}, \omega) \right] \hat{y} + \left[u_{r_z}(\vec{r}, \omega) + iu_{i_z}(\vec{r}, \omega) \right] \hat{z} \\ &= \left| \tilde{u}_x(\vec{r}, \omega) \right| e^{i\phi_{u_x}(\vec{r}, \omega)} \hat{x} + \left| \tilde{u}_y(\vec{r}, \omega) \right| e^{i\phi_{u_y}(\vec{r}, \omega)} \hat{y} + \left| \tilde{u}_z(\vec{r}, \omega) \right| e^{i\phi_{u_z}(\vec{r}, \omega)} \hat{z} \end{aligned}$$

Complex 3-D vector particle acceleration:

$$\begin{aligned} \vec{a}(\vec{r}, \omega) &= \vec{a}_r(\vec{r}, \omega) + i\vec{a}_i(\vec{r}, \omega) \\ &= \left[a_{r_x}(\vec{r}, \omega) + ia_{i_x}(\vec{r}, \omega) \right] \hat{x} + \left[a_{r_y}(\vec{r}, \omega) + ia_{i_y}(\vec{r}, \omega) \right] \hat{y} + \left[a_{r_z}(\vec{r}, \omega) + ia_{i_z}(\vec{r}, \omega) \right] \hat{z} \\ &= \left| \tilde{a}_x(\vec{r}, \omega) \right| e^{i\phi_{a_x}(\vec{r}, \omega)} \hat{x} + \left| \tilde{a}_y(\vec{r}, \omega) \right| e^{i\phi_{a_y}(\vec{r}, \omega)} \hat{y} + \left| \tilde{a}_z(\vec{r}, \omega) \right| e^{i\phi_{a_z}(\vec{r}, \omega)} \hat{z} \end{aligned}$$

Complex 3-D vector specific acoustic admittance:

$$\begin{aligned} \vec{y}_a(\vec{r}, \omega) &= \vec{y}_r(\vec{r}, \omega) + i\vec{y}_i(\vec{r}, \omega) \\ &= \left[y_{r_x}(\vec{r}, \omega) + iy_{i_x}(\vec{r}, \omega) \right] \hat{x} + \left[y_{r_y}(\vec{r}, \omega) + iy_{i_y}(\vec{r}, \omega) \right] \hat{y} + \left[y_{r_z}(\vec{r}, \omega) + iy_{i_z}(\vec{r}, \omega) \right] \hat{z} \\ &= \left| \tilde{y}_x(\vec{r}, \omega) \right| e^{i\phi_{y_x}(\vec{r}, \omega)} \hat{x} + \left| \tilde{y}_y(\vec{r}, \omega) \right| e^{i\phi_{y_y}(\vec{r}, \omega)} \hat{y} + \left| \tilde{y}_z(\vec{r}, \omega) \right| e^{i\phi_{y_z}(\vec{r}, \omega)} \hat{z} \end{aligned}$$

Complex 3-D vector specific acoustic impedance:

$$\begin{aligned} \vec{z}_a(\vec{r}, \omega) &= \vec{z}_r(\vec{r}, \omega) + i\vec{z}_i(\vec{r}, \omega) \\ &= \left[z_{r_x}(\vec{r}, \omega) + iz_{i_x}(\vec{r}, \omega) \right] \hat{x} + \left[z_{r_y}(\vec{r}, \omega) + iz_{i_y}(\vec{r}, \omega) \right] \hat{y} + \left[z_{r_z}(\vec{r}, \omega) + iz_{i_z}(\vec{r}, \omega) \right] \hat{z} \\ &= \left| \tilde{z}_x(\vec{r}, \omega) \right| e^{i\phi_{z_x}(\vec{r}, \omega)} \hat{x} + \left| \tilde{z}_y(\vec{r}, \omega) \right| e^{i\phi_{z_y}(\vec{r}, \omega)} \hat{y} + \left| \tilde{z}_z(\vec{r}, \omega) \right| e^{i\phi_{z_z}(\vec{r}, \omega)} \hat{z} \end{aligned}$$