For harmonic/single-frequency sound fields, we can obtain expressions for the real and imaginary parts of frequency-domain complex 3-D vector ***specific*** acoustic impedance $\vec{\tilde{z}}_a(\vec{r},\omega)$ and admittance $\vec{\tilde{y}}_a(\vec{r},\omega)$ in terms of the real and imaginary parts of complex scalar over-pressure $\tilde{p}(\vec{r},\omega)$ and complex 3-D vector particle velocity $\vec{\tilde{u}}(\vec{r},\omega)$ from their respective definitions $\vec{\tilde{z}}_a(\vec{r},\omega) = \tilde{p}(\vec{r},\omega)/\vec{\tilde{u}}(\vec{r},\omega)$ and $\vec{\tilde{y}}_a(\vec{r},\omega) = \vec{\tilde{u}}(\vec{r},\omega)/\tilde{p}(\vec{r},\omega) = 1/\vec{\tilde{z}}_a(\vec{r},\omega)$.

Suppressing the frequency-domain argument $(\vec{r},\omega)$ for notational clarity's sake, and working with only one of the three vectorial components $k = x, y,$ or z, for complex 3-D vector ***specific*** acoustic admittance:

$$\tilde{y}_{a_k} = y^{\mathrm{r}}_{a_k} + iy^{\mathrm{i}}_{a_k} = \frac{\tilde{u}_k}{\tilde{p}} = \frac{u_{\mathrm{r}_k} + iu_{\mathrm{i}_k}}{p_{\mathrm{r}} + ip_{\mathrm{i}}} = \left(\frac{u_{\mathrm{r}_k} + iu_{\mathrm{i}_k}}{p_{\mathrm{r}} + ip_{\mathrm{i}}}\right)\cdot\left(\frac{p_{\mathrm{r}} - ip_{\mathrm{i}}}{p_{\mathrm{r}} - ip_{\mathrm{i}}}\right) = \left(\frac{p_{\mathrm{r}}u_{\mathrm{r}_k} + p_{\mathrm{i}}u_{\mathrm{i}_k}}{|\tilde{p}|^2}\right) + i\left(\frac{p_{\mathrm{r}}u_{\mathrm{i}_k} - p_{\mathrm{i}}u_{\mathrm{r}_k}}{|\tilde{p}|^2}\right)$$

Thus we see that for $k = x, y,$ or z:

$$y^{\mathrm{r}}_{a_k} = \mathrm{Re}\{\tilde{y}_{a_k}\} = \frac{p_{\mathrm{r}}u_{\mathrm{r}_k} + p_{\mathrm{i}}u_{\mathrm{i}_k}}{|\tilde{p}|^2} \text{ and: } y^{\mathrm{i}}_{a_k} = \mathrm{Im}\{\tilde{y}_{a_k}\} = \frac{p_{\mathrm{r}}u_{\mathrm{i}_k} - p_{\mathrm{i}}u_{\mathrm{r}_k}}{|\tilde{p}|^2} = -\frac{p_{\mathrm{i}}u_{\mathrm{r}_k} - p_{\mathrm{r}}u_{\mathrm{i}_k}}{|\tilde{p}|^2}$$

Likewise, for complex 3-D vector ***specific*** acoustic impedance:

$$\tilde{z}_{a_k} = z^{\mathrm{r}}_{a_k} + iz^{\mathrm{i}}_{a_k} = \frac{\tilde{p}\cdot\tilde{u}^*_k}{|\vec{\tilde{u}}|^2} = \frac{(p_{\mathrm{r}} + ip_{\mathrm{i}})(u_{\mathrm{r}_k} + iu_{\mathrm{i}_k})^*}{|\vec{\tilde{u}}|^2} = \frac{(p_{\mathrm{r}} + ip_{\mathrm{i}})(u_{\mathrm{r}_k} - iu_{\mathrm{i}_k})}{|\vec{\tilde{u}}|^2} = \left(\frac{p_{\mathrm{r}}u_{\mathrm{r}_k} + p_{\mathrm{i}}u_{\mathrm{i}_k}}{|\vec{\tilde{u}}|^2}\right) + i\left(\frac{p_{\mathrm{i}}u_{\mathrm{r}_k} - p_{\mathrm{r}}u_{\mathrm{i}_k}}{|\vec{\tilde{u}}|^2}\right)$$

Thus, we see that for $k = x, y,$ or z:

$$z^{\mathrm{r}}_{a_k} = \mathrm{Re}\{\tilde{z}_{a_k}\} = \frac{p_{\mathrm{r}}u_{\mathrm{r}_k} + p_{\mathrm{i}}u_{\mathrm{i}_k}}{|\vec{\tilde{u}}|^2} \text{ and: } z^{\mathrm{i}}_{a_k} = \mathrm{Im}\{\tilde{z}_{a_k}\} = \frac{p_{\mathrm{i}}u_{\mathrm{r}_k} - p_{\mathrm{r}}u_{\mathrm{i}_k}}{|\vec{\tilde{u}}|^2}$$

Noting that: $|\tilde{y}_{a_k}|^2 = \tilde{y}_{a_k}\bullet\tilde{y}^*_{a_k} = \frac{\tilde{u}_k}{\tilde{p}}\bullet\frac{\tilde{u}^*_k}{\tilde{p}^*} = \frac{|\tilde{u}_k|^2}{|\tilde{p}|^2}$ and that: $|\tilde{z}_{a_k}|^2 = \tilde{z}_{a_k}\bullet\tilde{z}^*_{a_k} = \frac{\tilde{p}\tilde{u}^*_k}{|\vec{\tilde{u}}|^2}\bullet\frac{\tilde{p}^*\tilde{u}_k}{|\vec{\tilde{u}}|^2} = \frac{|\tilde{p}|^2|\tilde{u}_k|^2}{\left(|\vec{\tilde{u}}|^2\right)^2}$

We see that: $|\vec{\tilde{u}}|^2 z^{\mathrm{r}}_{a_k} = p_{\mathrm{r}}u_{\mathrm{r}_k} + p_{\mathrm{i}}u_{\mathrm{i}_k} = |\tilde{p}|^2 y^{\mathrm{r}}_{a_k}$ and that: $|\vec{\tilde{u}}|^2 z^{\mathrm{i}}_{a_k} = p_{\mathrm{i}}u_{\mathrm{r}_k} - p_{\mathrm{r}}u_{\mathrm{i}_k} = -|\tilde{p}|^2 y^{\mathrm{i}}_{a_k}$

or equivalently that: $z^{\mathrm{r}}_{a_k} = |\vec{\tilde{z}}_a|^2 y^{\mathrm{r}}_{a_k}$ or: $y^{\mathrm{r}}_{a_k} = |\vec{\tilde{y}}_a|^2 z^{\mathrm{r}}_{a_k}$ and that: $z^{\mathrm{i}}_{a_k} = -|\vec{\tilde{z}}_a|^2 y^{\mathrm{i}}_{a_k}$ or: $y^{\mathrm{i}}_{a_k} = -|\vec{\tilde{y}}_a|^2 z^{\mathrm{i}}_{a_k}$