Thus, we see that for a given $k = x, y,$ or z component of $\vec{\tilde{z}}_a(\vec{r},\omega)$:

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

and we see that for a given $k = x, y,$ or z component of $\vec{\tilde{y}}_a(\vec{r},\omega)$:

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

as well as: $\tilde{z}_{a_k} = \dfrac{\tilde{y}^*_{a_k}}{\left|\vec{\tilde{y}}_a\right|^2}$ and: $\tilde{y}_{a_k} = \dfrac{\tilde{z}^*_{a_k}}{\left|\vec{\tilde{z}}_a\right|^2}$ or equivalently: $\tilde{y}_{a_k} = \left|\vec{\tilde{y}}_a\right|^2 \tilde{z}^*_{a_k}$ and: $\tilde{z}_{a_k} = \left|\vec{\tilde{z}}_a\right|^2 \tilde{y}^*_{a_k}$.

It can be seen from these definitions that in **general** the individual vectorial components $k = x, y,$ or z that: $\tilde{z}_{a_k}(\vec{r},\omega)$ and $\tilde{y}_{a_k}(\vec{r},\omega)$ do ***not*** point in the same direction in space.

Since $\vec{\tilde{z}}_a(\vec{r},\omega) = \tilde{p}(\vec{r},\omega)/\vec{\tilde{u}}(\vec{r},\omega)$, another useful relation is: $\vec{\tilde{z}}_a(\vec{r},\omega)\bullet\vec{\tilde{u}}(\vec{r},\omega) = \tilde{p}(\vec{r},\omega)$:

$$\vec{\tilde{z}}_a(\vec{r},\omega)\bullet\vec{\tilde{u}}(\vec{r},\omega) = \left[\frac{\tilde{p}(\vec{r},\omega)}{\vec{\tilde{u}}(\vec{r},\omega)}\right]\bullet\vec{\tilde{u}}(\vec{r},\omega) = \left[\frac{\tilde{p}(\vec{r},\omega)\vec{\tilde{u}}^*(\vec{r},\omega)}{\left|\vec{\tilde{u}}(\vec{r},\omega)\right|^2}\right]\bullet\vec{\tilde{u}}(\vec{r},\omega) = \frac{\tilde{p}(\vec{r},\omega)\cancel{\left|\vec{\tilde{u}}(\vec{r},\omega)\right|^2}}{\cancel{\left|\vec{\tilde{u}}(\vec{r},\omega)\right|^2}}$$

$$= \tilde{p}(\vec{r},\omega)$$

Similarly, since $\vec{\tilde{y}}_a(\vec{r},\omega) = \vec{\tilde{u}}(\vec{r},\omega)/\tilde{p}(\vec{r},\omega)$, then: $\vec{\tilde{y}}_a(\vec{r},\omega)\,\tilde{p}(\vec{r},\omega) = \vec{\tilde{u}}(\vec{r},\omega)$.

Note that the above expressions for the real and imaginary components of complex acoustic specific impedance and/or admittance given in terms of linear combinations of the real and imaginary components of complex scalar acoustic over-pressure and complex vector particle velocity. As we have discussed previously, the physical meaning of the real and imaginary components of complex scalar acoustic over-pressure and complex vector particle velocity are respectively the in-phase and 90° (quadrature) components relative to the driving sound source. However, this is ***not*** the physical meaning of the real and imaginary components of complex acoustic specific immittances, because of the above-defined linear combinations of complex scalar acoustic over-pressure and complex vector particle velocity. We shall see/learn that the physical meaning of the real and imaginary components of complex acoustic immittances – properties of the physical medium in which acoustic disturbances propagate – are respectively associated with the ***propagating*** and ***non-propagating*** components of acoustic energy density.

The real and imaginary components of the acoustic specific immittances are often called the ***active*** and ***reactive*** components of the complex sound field, respectively, since (see above):

$$\boxed{\vec{\tilde{z}}_a(\vec{r},\omega) \equiv \vec{r}_a(\vec{r},\omega) + i\vec{\chi}_a(\vec{r},\omega) \quad (\Omega_a)} \text{ and: } \boxed{\vec{\tilde{y}}_a(\vec{r},\omega) \equiv \vec{g}_a(\vec{r},\omega) + i\vec{b}_a(\vec{r},\omega) \quad (\Omega_a^{-1})}$$