The $k = x, y, z$ components of the ***frequency domain*** complex 3-D vector ***specific immittances*** at the listener's position $\vec{r}$ are:

$$\tilde{z}_{a_k}(\omega) = \frac{\tilde{p}(\omega)}{\tilde{u}_k(\omega)} = \frac{\tilde{u}_k^*(\omega)\cdot\tilde{p}(\omega)}{\tilde{u}_k^*(\omega)\cdot\tilde{u}_k(\omega)} = \frac{\tilde{u}_k^*(\omega)\cdot\tilde{p}(\omega)}{\left|\tilde{u}_k(\omega)\right|^2} = \frac{2\tilde{I}_{a_k}(\omega)}{\left|\tilde{u}_k(\omega)\right|^2} = \frac{\tilde{S}_{u_k\star p}(\omega)}{\tilde{S}_{u_k\star u_k}(\omega)} = \frac{\tilde{G}_{u_k\star p}(\omega)}{\tilde{G}_{u_k\star u_k}(\omega)} = \frac{\tilde{G}^*_{p\star u_k}(\omega)}{\tilde{G}_{u_k\star u_k}(\omega)}$$

and: $$\tilde{y}_{a_k}(\omega) = \frac{1}{\tilde{z}_{a_k}(\omega)} = \frac{\tilde{u}_k(\omega)}{\tilde{p}(\omega)} = \frac{\tilde{u}_k(\omega)\cdot\tilde{p}^*(\omega)}{\tilde{p}(\omega)\cdot\tilde{p}^*(\omega)} = \frac{2\tilde{I}_{a_k}(\omega)}{\left|\tilde{p}(\omega)\right|^2} = \frac{\tilde{S}_{p\star u_k}(\omega)}{\tilde{S}_{p\star p}(\omega)} = \frac{\tilde{G}_{p\star u_k}(\omega)}{\tilde{G}_{p\star p}(\omega)} = \frac{\tilde{G}^*_{u_k\star p}(\omega)}{\tilde{G}_{p\star p}(\omega)}$$

Since $\tilde{y}_{a_k}(\vec{r},\omega) = 1/\tilde{z}_{a_k}(\vec{r},\omega)$, we also see that:

$$\tilde{z}_{a_k}(\omega) = \frac{\tilde{G}_{u_k\star p}(\omega)}{\tilde{G}_{u_k\star u_k}(\omega)} = \frac{\tilde{G}^*_{p\star u_k}(\omega)}{\tilde{G}_{u_k\star u_k}(\omega)} = \frac{1}{\tilde{y}_{a_k}(\omega)} = \frac{\tilde{G}_{p\star p}(\omega)}{\tilde{G}_{p\star u_k}(\omega)} = \frac{\tilde{G}_{p\star p}(\omega)}{\tilde{G}^*_{u_k\star p}(\omega)}$$

Thus, we also see that:

$$\tilde{G}_{p\star p}(\omega)\cdot\tilde{G}_{u_k\star u_k}(\omega) = \tilde{G}_{p\star u_k}(\omega)\cdot\tilde{G}_{u_k\star p}(\omega) = \tilde{G}^*_{u_k\star p}(\omega)\cdot\tilde{G}^*_{p\star u_k}(\omega) = \left|\tilde{I}_{a_k}(\omega)\right|^2$$

We can also define corresponding $k = x, y, z$ vector components of the ***frequency-domain*** complex 3-D vector ***sound field coherence function*** $\vec{\tilde{\gamma}}_{p\star u_k}(\omega)$ {*n.b.* essentially the normalized (& dimensionless) complex 3-D vector acoustic intensity} as:

$$\vec{\tilde{\gamma}}_{u_k\star p}(\omega) \equiv \frac{\vec{\tilde{S}}_{u_k\star p}(\omega)}{\sqrt{\tilde{S}_{p\star p}(\omega)\cdot\tilde{S}_{u_k\star u_k}(\omega)}} = \frac{\vec{\tilde{G}}_{u_k\star p}(\omega)}{\sqrt{\tilde{G}_{p\star p}(\omega)\cdot\tilde{G}_{u_k\star u_k}(\omega)}}$$

where: $$\vec{\tilde{\gamma}}_{u\star p}(\omega) = \tilde{\gamma}_{u_x\star p}(\omega)\hat{x} + \tilde{\gamma}_{u_y\star p}(\omega)\hat{y} + \tilde{\gamma}_{u_z\star p}(\omega)\hat{z}$$

Note that the ***magnitudes*** of the individual $k = x, y, z$ components of the ***frequency-domain*** complex 3-D vector ***sound field coherence function*** are constrained to lie within the range: $0 \le \left|\tilde{\gamma}_{u_k\star p}(\omega)\right| \le 1$, *i.e.* the individual $k = x, y, z$ vector components are constrained to lie on, or within the ***unit circle*** in the complex plane, centered at (0,0).

When $\left|\tilde{\gamma}_{u_k\star p}(\omega)\right| \simeq 1$, the k^{th} component of a polyphonic complex sound field $\tilde{S}(\vec{r},t;\omega)$ is ***fully-coherent*** (*e.g.* at a listener's position *r* some distance away from a point sound source), whereas when $\left|\tilde{\gamma}_{u_k\star p}(\omega)\right| \simeq 0$, the k^{th} component of a polyphonic complex sound field is ***completely incoherent*** (*e.g.* at a listener's position deep inside the ***reverberant*** portion of a polyphonic complex sound field $\tilde{S}(\vec{r},t;\omega)$ associated with a large listening room and/or auditorium, concert hall, *etc*.).