Likewise, the real and imaginary parts of the complex radial acoustic energy flow velocity are:

$$c_{a_r}^{r}(r,\omega)=\text{Re}\{\tilde{c}_{a_r}(r,\omega)\}=c\frac{1}{\left[1+(1/kr)^2\right]} \quad \text{and:} \quad c_{a_r}^{i}(r,\omega)=\text{Im}\{\tilde{c}_{a_r}(r,\omega)\}=c\frac{1/kr}{\left[1+(1/kr)^2\right]}$$

The phase of the complex radial ***specific*** acoustic impedance and complex radial acoustic energy flow velocity is:

$$\varphi_{z_a}=\varphi_{c_a}=\Delta\varphi_{p-u}=\varphi_p-\varphi_u=\tan^{-1}(1/kr)$$

(a) **In the "near" zone:** $kr \ll 1$, the complex radial ***specific*** acoustic impedance and the complex radial energy flow velocity are both largely ***imaginary*** (*i.e.* ***reactive***): $\tilde{z}_{a_r}(r)/z_o=\tilde{c}_{a_r}(r)/c=[1+i/kr]\big/\left[1+(1/kr)^2\right]\sim i\cdot kr$, increasing ~ linearly with *r*, with fractional magnitude $|\tilde{z}_{a_r}(r)|/z_o=|\tilde{c}_{a_r}(r)|/c=1\big/\sqrt{1+(1/kr)^2}\sim kr\ll 1$ and phase $\varphi_{z_a}=\varphi_{c_a}=\varphi_p-\varphi_u=\tan^{-1}(1/kr)\sim\tan^{-1}(\infty)\sim 90^{\circ}$. Again, the complex sound field $\tilde{S}(\vec{r},t)$ in this region is ***inertia***-like (*i.e.* ***mass***-like), because $z_{a_r}^{i}(r)=\text{Im}\{\tilde{z}_{a_r}(r)\}>0$ for $kr\ll 1$.

(b) **In the "intermediate zone:** $kr\sim 1$, the complex radial ***specific*** acoustic impedance and the complex radial energy flow are both ~ an equal mix of ***active*** (*i.e.* real) and ***reactive*** (*i.e.* imaginary) components: $\tilde{z}_{a_r}(r)/z_o=\tilde{c}_{a_r}(r)/c=[1+i/kr]\big/\left[1+(1/kr)^2\right]\sim(1+i)/2$, with fractional magnitude $|\tilde{z}_{a_r}(r)|/z_o=|\tilde{c}_{a_r}(r)|/c=1\big/\sqrt{1+(1/kr)^2}\sim 1/\sqrt{2}$ and phase $\varphi_{z_a}=\varphi_{c_a}=\varphi_p-\varphi_u=\tan^{-1}(1/kr)\sim\tan^{-1}(1)\sim 45^{\circ}$.

(c) **In the "far" (or radiation) zone:** $kr\gg 1$, the complex radial ***specific*** acoustic impedance and the complex radial energy flow velocity are largely ***real*** (*i.e.* ***active***): $\tilde{z}_{a_r}(r)/z_o=\tilde{c}_{a_r}(r)/c=1\big/\left[1+(1/kr)^2\right]\sim 1$ with magnitude $|\tilde{z}_{a_r}(r)|/z_o=|\tilde{c}_{a_r}(r)|/c=1\big/\sqrt{1+(1/kr)^2}\sim 1$ and phase $\varphi_{z_a}=\varphi_{c_a}=\varphi_p-\varphi_u=\tan^{-1}(1/kr)\sim\tan^{-1}(0)\sim 0^{\circ}$.

The ***frequency domain*** complex radial acoustic intensity associated with the point acoustic monopole also points outward in the radial ($\hat{r}$) direction; it and its magnitude are:

$$\tilde{I}_{a_r}(r,\omega)\equiv\frac{1}{2}\tilde{p}(r,\omega)\cdot\tilde{u}_r^{*}(r,\omega)=\frac{1}{2}\frac{1}{z_o}\frac{B_o^2}{r^2}\left[1+\frac{i}{kr}\right] \quad \text{and:} \quad |\tilde{I}_{a_r}(r,\omega)|=\frac{1}{2}\frac{1}{z_o}\frac{B_o^2}{r^2}\sqrt{1+(1/kr)^2}$$

The real and imaginary parts of the ***frequency domain*** radial complex acoustic intensity are:

$$I_{a_r}^{r}(r,\omega)=\text{Re}\{\tilde{I}_{a_r}(r,\omega)\}=\frac{1}{2}\frac{1}{z_o}\frac{B_o^2}{r^2} \quad \text{and:} \quad I_{a_r}^{i}(r,\omega)=\text{Im}\{\tilde{I}_{a_r}(r,\omega)\}=\frac{1}{2}\frac{1}{z_o}\frac{B_o^2}{r^2}\frac{1}{kr}$$