and we see that:

$$\varphi_{z_{a\,tot}}(x,\omega) \equiv \tan^{-1}\left(\frac{\mathrm{Im}\left\{\tilde{z}^{\parallel}_{a\,tot}(x,\omega)\right\}}{\mathrm{Re}\left\{\tilde{z}^{\parallel}_{a\,tot}(x,\omega)\right\}}\right) = \tan^{-1}\left(\frac{2\left|\tilde{R}\right|\sin\left(2kx+\Delta\varphi^{o}_{BA}\right)}{\left\{1-\left|\tilde{R}\right|^{2}\right\}}\right)$$

$$= \Delta\varphi_{p_{tot}-u^{\parallel}_{tot}}(x,\omega) = \varphi_{p_{tot}}(x,\omega) - \varphi_{u^{\parallel}_{tot}}(x,\omega) =$$

$$\varphi_{c_{a\,tot}}(x,\omega) \equiv \tan^{-1}\left(\frac{\mathrm{Im}\left\{\tilde{c}^{\parallel}_{a\,tot}(x,\omega)\right\}}{\mathrm{Re}\left\{\tilde{c}^{\parallel}_{a\,tot}(x,\omega)\right\}}\right)$$

Hence, we also see that:

$$\varphi_{I_{a\,tot}}(x,\omega) = \varphi_{z_{a\,tot}}(x,\omega) = \varphi_{c_{a\,tot}}(x,\omega) = \Delta\varphi_{p_{tot}-u^{\parallel}_{tot}}(x,\omega) = \varphi_{p_{tot}}(x,\omega) - \varphi_{u^{\parallel}_{tot}}(x,\omega)$$

$$= \tan^{-1}\left(\frac{2\left|\tilde{R}\right|\sin\left(2kx+\Delta\varphi^{o}_{BA}\right)}{\left\{1-\left|\tilde{R}\right|^{2}\right\}}\right)$$

When $\left|\tilde{R}\right| \equiv \left|\tilde{B}\right| / \left|\tilde{A}\right| = 1$ (*i.e.* a ***pure*** standing wave!), then:

$$\tilde{I}^{\parallel}_{a_{tot}}(x,\omega) \equiv \tfrac{1}{2}\,\tilde{p}_{tot}(x,\omega)\cdot\tilde{u}^{\parallel *}_{tot}(x,\omega) = \frac{1}{2}\frac{\left|\tilde{A}\right|^{2}}{z_o}\left[\left\{1-\left|\tilde{R}\right|^{2}\right\} + 2i\left|\tilde{R}\right|\sin\left(2kx+\Delta\varphi^{o}_{BA}\right)\right] = \tilde{I}^{\parallel}_{a_{tot}\,\mathrm{r}}(x,\omega) + i\tilde{I}^{\parallel}_{a_{tot}\,\mathrm{i}}(x,\omega)$$

For an observer/listener's position at $x = 0$ **.and.** $\left|\tilde{R}\right| = 1$, this reduces to:

$$\tilde{I}^{\parallel}_{a_{tot}}(x=0,\omega) \equiv \tfrac{1}{2}\,\tilde{p}_{tot}(x=0,\omega)\cdot\tilde{u}^{\parallel *}_{tot}(x=0,\omega) = i\frac{\left|\tilde{A}\right|^{2}}{z_o}\sin\Delta\varphi^{o}_{BA}$$ (*n.b.* ***purely imaginary quantity***!)

We see again that when additionally: $\Delta\varphi^{o}_{BA} = 0, \pm 1\pi, \pm 2\pi, \pm 3\pi, \ldots = \pm n\pi$ that: $\tilde{I}^{\parallel}_{a_{tot}}(x=0,t) = 0$!!!

Similarly, we see that $\tilde{I}^{\parallel}_{a_{tot}}(x=0,\omega)$ has a purely ***imaginary*** ***extremum*** amplitude of $\pm\left|\tilde{A}\right|^{2} / \rho_o c = \pm\left|\tilde{A}\right|^{2} / z_o$ when $\Delta\varphi_{AB} = \pm\pi/2, \pm 3\pi/2, \pm 5\pi/2, \ldots = \pm m_{odd}\pi/2$.

Physically, the ***real*** part of the complex ***frequency-domain*** longitudinal acoustic intensity $\tilde{I}^{\parallel}_{a_{tot}}(x,\omega)$ represents the ***frequency-domain*** "amplitude" of the ***net flux/flow*** of acoustic energy crossing unit area per unit time (SI units *Watts*/m^2) – *i.e.* the ***real*** part of the complex acoustic intensity is physically associated with ***propagating*** sound/sound ***radiation***. The ***imaginary*** part of the complex ***frequency-domain*** longitudinal acoustic intensity is physically associated with ***non-propagating*** acoustic energy, *i.e.* energy sloshing back and forth each cycle of oscillation.