$$\frac{\left|\tilde{z}^{||}_{a\,tot}(x)\right|_{\text{minima}}}{z_o} = \frac{\sqrt{\left\{1-\left|\tilde{R}\right|^2\right\}^2 + 4\left|\tilde{R}\right|^2 \sin^2\left(2kx+\Delta\varphi^o_{BA}\right)}}{\left[\left\{1+\left|\tilde{R}\right|^2\right\} - 2\left|\tilde{R}\right|\cos\left(2kx+\Delta\varphi^o_{BA}\right)\right]} = \frac{\sqrt{\left\{1-\left|\tilde{R}\right|^2\right\}^2}}{\left[\left\{1+\left|\tilde{R}\right|^2\right\}+2\left|\tilde{R}\right|\right]}$$

$$= \left(\frac{1-\left|\tilde{R}\right|^2}{1+2\left|\tilde{R}\right|+\left|\tilde{R}\right|^2}\right) = \left(\frac{1-\left|\tilde{R}\right|^2}{\left(1+\left|\tilde{R}\right|\right)^2}\right) = \frac{\left(1-\left|\tilde{R}\right|\right)\cdot\cancel{\left(1+\left|\tilde{R}\right|\right)}}{\left(1+\left|\tilde{R}\right|\right)\cdot\cancel{\left(1+\left|\tilde{R}\right|\right)}} = \frac{\left(1-\left|\tilde{R}\right|\right)}{\left(1+\left|\tilde{R}\right|\right)} = \frac{\left|\tilde{c}^{||}_{a\,tot}(x)\right|_{\text{minima}}}{c}$$

The phase(s) associated with the complex longitudinal ***specific*** acoustic impedance and complex energy flow velocity ***minima*** are:

$$\varphi_{z_a}(x)\Big|_{\text{minima}} = \tan^{-1}\left(\frac{2\left|\tilde{R}\right|\sin\left(2kx+\Delta\varphi^o_{BA}\right)}{\left\{1-\left|\tilde{R}\right|^2\right\}}\right) = \tan^{-1}(0) = 0$$

$$= \Delta\varphi_{p_{tot}-u_{tot}}(x)\Big|_{\text{minima}} = \left(\varphi_{p_{tot}}(x) - \varphi_{u_{tot}}(x)\right)_{\text{minima}} = \varphi_{c_a}(x)\Big|_{\text{minima}}$$

Thus, for longitudinal ***specific*** acoustic impedance and longitudinal energy flow velocity ***minima*** associated with this situation, we see that the total/resultant complex pressure $\tilde{p}_{tot}(x,t)$ and longitudinal particle velocity $\tilde{u}^{||}_{tot}(x,t)$ are precisely ***out-of-phase*** with each other, or at least by ± ***odd*** integer multiples of π. Since $\left|\tilde{z}^{||}_{tot}(x)\right|_{\text{minima}} = \left|\tilde{p}_{tot}(x,t)\right| / \left|\tilde{u}^{||}_{tot}(x,t)\right|_{\text{minima}}$ this also tells us that whenever $(2kx+\Delta\varphi_{BA}) = \pm1\pi, \pm3\pi, \pm5\pi ... = \pm n_{odd}\pi$, the magnitude of the total/resultant complex pressure $\left|\tilde{p}_{tot}(x,t)\right|$ will also be a ***minima***, whereas the magnitude of the total/resultant complex longitudinal particle velocity $\left|\tilde{u}^{||}_{tot}(x,t)\right|$ will simultaneously be a ***maxima***:

$$\tilde{p}_{tot}(x,t) = \tilde{A}\left[1 + \left|\tilde{R}\right| e^{i\left(2kx+\Delta\varphi^o_{BA}\right)}\right]\cdot e^{i(\omega t-kx)} = \tilde{A}\left[1 + \left|\tilde{R}\right| e^{\pm i n_{odd}\pi}\right]\cdot e^{i(\omega t-kx)}$$

$$= \tilde{A}\left[1 + \left|\tilde{R}\right|\left\{\cos(\pm n_{odd}\pi) + \cancel{i\sin(\pm n_{odd}\pi)}\right\}\right]\cdot e^{i(\omega t-kx)} = \tilde{A}\left[1 - \left|\tilde{R}\right|\right]\cdot e^{i(\omega t-kx)}$$

and:

$$\tilde{u}^{||}_{tot}(x,t) = \frac{\tilde{A}}{\rho_o c}\left[1 - \left|\tilde{R}\right| e^{i\left(2kx+\Delta\varphi^o_{BA}\right)}\right]\cdot e^{i(\omega t-kx)} = \frac{\tilde{A}}{\rho_o c}\left[1 - \left|\tilde{R}\right| e^{\pm i n_{odd}\pi}\right]\cdot e^{i(\omega t-kx)}$$

$$= \frac{\tilde{A}}{\rho_o c}\left[1 - \left|\tilde{R}\right|\left\{\cos(\pm n_{odd}\pi) + \cancel{i\sin(\pm n_{odd}\pi)}\right\}\right]\cdot e^{i(\omega t-kx)} = \frac{\tilde{A}}{\rho_o c}\left[1 + \left|\tilde{R}\right|\right]\cdot e^{i(\omega t-kx)}$$

$$\Rightarrow \quad \left|\tilde{p}_{tot}(x,t)\right| \equiv \sqrt{\tilde{p}_{tot}(x,t)\cdot\tilde{p}^*_{tot}(x,t)} = \left|\tilde{A}\right|\left[1 - \left|\tilde{R}\right|\right] \qquad \text{for } \left|\tilde{R}\right| = 1:\ \left|\tilde{p}_{tot}(x,t)\right| = 0$$

$$\Rightarrow \quad \left|\tilde{u}^{||}_{tot}(x,t)\right| \equiv \sqrt{\tilde{u}^{||}_{tot}(x,t)\cdot\tilde{u}^{||*}_{tot}(x,t)} = \frac{\left|\tilde{A}\right|}{\rho_o c}\left[1 + \left|\tilde{R}\right|\right] \qquad \text{for } \left|\tilde{R}\right| = 1:\ \left|\tilde{u}^{||}_{tot}(x,t)\right| = \frac{2\left|\tilde{A}\right|}{\rho_o c}$$

"Pure" standing wave!!!