Acoustic Reflectance/Transmittance/Absorbance and Acoustic Reflection/Transmission/Absorption Coefficients:

The physical meaning of the complex quantity $\tilde{R} \equiv \tilde{B}/\tilde{A} = |\tilde{R}| e^{i\Delta\varphi^o_{BA}}$ used in (all of) the above formulae for this two counter-propagating monochromatic plane waves problem can also be used to describe various other types of acoustical physics situations, *e.g.* by interpreting $\tilde{R}$ as the ***complex acoustic reflectance*** associated with a sound wave reflecting off of a surface. The {purely real} ***reflection coefficient*** associated with the surface is then defined as: $0 \le \mathbb{R} \equiv |\tilde{R}|^2 = \tilde{R} \cdot \tilde{R}^* \le 1$.

If a sound wave is only partially reflected from a surface, then it is either partially transmitted (with complex acoustic ***transmittance*** $\tilde{T}$ and corresponding {purely real}***transmission coefficient*** $0 \le \mathbb{T} \equiv |\tilde{T}|^2 = \tilde{T} \cdot \tilde{T}^* \le 1$) and/or is absorbed by the surface (with complex acoustic ***absorbance*** $\tilde{A}$ and corresponding {purely real} ***absorption coefficient*** $0 \le \mathbb{A} \equiv |\tilde{A}|^2 = \tilde{A} \cdot \tilde{A}^* \le 1$), since we ***must*** have (by conservation of energy at the surface/interface): $\mathbb{R} + \mathbb{T} + \mathbb{A} = 1$.

Limiting/Special Cases of Interest:

1.) A single monochromatic traveling plane wave (emitted from a sound source *e.g.* located at $x = -\infty$) propagating in the +*ve* *x*-direction and reflects, at normal incidence, off of a ***rigid***, ***perfectly reflecting*** infinite plane (*e.g.* located at $x = x_o > 0$), thereby producing a reflected wave (of ***equal*** amplitude) that propagates in the –*ve* *x*-direction. This situation corresponds to $\tilde{R} = |\tilde{R}| e^0 = +1$ at $x = x_o > 0$, which has the associated boundary condition $\tilde{p}_{refl}(x = x_o, t) = \tilde{p}_{inc}(x = x_o, t)$, *i.e.* **no** phase change occurs upon reflection, such that an over-pressure ***anti-node*** exists at $x = x_o > 0$:

$$\tilde{p}_{tot}(x = x_o, t) = \tilde{p}_{inc}(x = x_o, t) + \tilde{p}_{refl}(x = x_o, t) = 2\tilde{p}_{inc}(x = x_o, t).$$

2.) A single monochromatic traveling plane wave (emitted from a sound source *e.g.* located at $x = -\infty$) propagating in the +*ve* *x*-direction and reflects, at normal incidence, off of an infinite ***pressure-release*** plane consisting of an air-water interface (located at $x = x_o > 0$), thereby producing a reflected wave (of equal amplitude) that propagates in the –*ve* *x*-direction.

This situation corresponds to $\tilde{R} = |\tilde{R}| e^{i\pi} = -1$. An air-water interface (*n.b.* "viewed" from the water side) closely approximates an ***ideal pressure-release surface***, for which the boundary condition at the pressure-release surface is $\tilde{p}_{refl}(x = x_o, t) = -\tilde{p}_{inc}(x = x_o, t)$ (*i.e.* a phase change of 180^o occurs upon reflection), such that an over-pressure ***node*** exists at $x = x_o > 0$:

$$\tilde{p}_{tot}(x = x_o, t) = \tilde{p}_{inc}(x = x_o, t) - \tilde{p}_{refl}(x = x_o, t) = 0.$$