

Mathematical equations of hyperbel functions

See: Papula, L., (2003), *Mathematische Formelsammlung*, Vieweg

$$\sinh(x) = \frac{10^{x_r/a'} - 10^{-x_r/a'}}{2} \quad [1], \quad \cosh(x) = \frac{10^{x_r/a'} + 10^{-x_r/a'}}{2} \quad [2]$$

$$\tanh(x) = \frac{\sinh(x)}{\cosh(x)} = \frac{10^{x_r/a'} - 10^{-x_r/a'}}{10^{x_r/a'} + 10^{-x_r/a'}} \quad [3]$$

$$\tanh(x/2) = \frac{\sinh(x)}{\cosh(x)+1} = \frac{\cosh(x)+1}{\sinh(x)} = \frac{10^{x_r/2a'} - 10^{-x_r/2a'}}{10^{x_r/2a'} + 10^{-x_r/2a'}} \quad [4]$$

$$\sinh^2(x) + \cosh^2(x) = 1 \quad [5]$$