

Mathematical equations of hyperbel functions

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

$$F(x/a) = \tanh(x/a) = \frac{e^{x/a} - e^{-x/a}}{e^{x/a} + e^{-x/a}} = \frac{u(x/a)}{v(x/a)} \quad [1]$$

$$F'(x/a) = \frac{u'(x/a)v(x/a) - u(x/a)v'(x/a)}{v^2(x/a)} \quad [2]$$

$$F'(x/a) = \frac{v^2(x/a) - u^2(x/a)}{a v^2(x/a)} \quad [3]$$

$$F'(x/a) = \frac{4}{a [e^{x/a} + e^{-x/a}]^2} = \frac{1}{a \cosh^2(x/a)} \quad [4]$$