

Mathematical equations of hyperbel functions

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

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

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

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

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