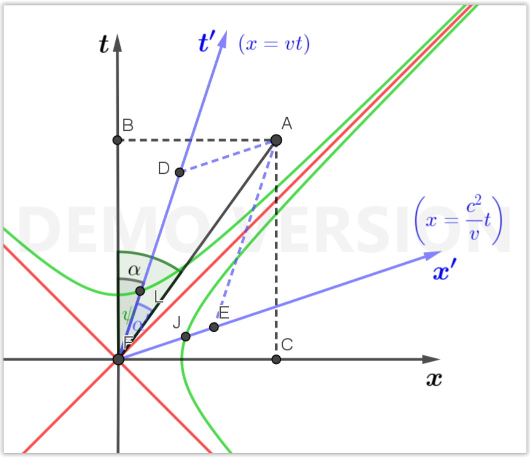

$$c = 1; \quad v < 1 \tag{1}$$

$$\Downarrow \tag{2}$$

$$\begin{cases} t^2 - x^2 = {t'}^2 - {x'}^2 = \tau^2 & (3) \\ v = \tanh\psi; \quad u = \dfrac{x}{t} = \tanh\alpha; & (4) \\ u' = \dfrac{x'}{t'} = \tanh\alpha' & (5) \\ \alpha' = \alpha - \psi & (6) \end{cases}$$

$$c = 1; \quad v > 1 \tag{7}$$

$$\Downarrow \tag{8}$$

$$\begin{cases} x^2 - t^2 = {x'}^2 - {t'}^2 = l^2 & (9) \\ v = \coth\psi; \quad u = \dfrac{x}{t} = \coth\alpha; & (10) \\ u' = \dfrac{x'}{t'} = \coth\alpha' & (11) \\ \alpha' = \alpha - \psi & (12) \end{cases}$$

$$\begin{cases} t' = t\cosh\psi - x\sinh\psi & (13) \\ x' = -t\sinh\psi + x\cosh\psi & (14) \end{cases}$$

$$u = \frac{x}{t}; \quad u' = \frac{x'}{t'} \tag{15}$$

$$u' = \frac{u - v}{1 - uv} \tag{16}$$

$$\coth\alpha' = \frac{\coth\alpha - \tanh\psi}{1 - \coth\alpha\tanh\psi}$$

$$= \frac{1 - \coth\psi\coth\alpha}{\coth\alpha - \coth\psi} = \coth(\alpha - \psi) \tag{17}$$

$$v = \coth\psi \tag{18}$$

$$\begin{cases} \cosh\psi = \dfrac{\coth\psi}{\sqrt{\coth^2\psi - 1}} = \dfrac{v}{\sqrt{v^2 - 1}}; & (19) \\ \sinh\psi = \dfrac{1}{\sqrt{\coth^2\psi - 1}} = \dfrac{1}{\sqrt{v^2 - 1}} & (20) \end{cases}$$

The corresponding coordinaten transformation is:

$$\begin{cases} t' = \dfrac{vt - x}{\sqrt{v^2 - 1}} = \dfrac{\frac{v}{c}t - \frac{x}{c}}{\sqrt{\frac{v^2}{c^2} - 1}} & (21) \\ x' = \dfrac{-ct + \frac{v}{c}x}{\sqrt{\frac{v^2}{c^2} - 1}} & (22) \end{cases}$$

$$\begin{cases} t' = \dfrac{t - \frac{x}{v}}{\sqrt{1 - \frac{c^2}{v^2}}} & (23) \\ x' = \dfrac{x - \frac{c^2}{v}t}{\sqrt{1 - \frac{c^2}{v^2}}} & (24) \end{cases}$$

Please take a look at the following animation:
`https://youtu.be/vSWlEoS9Hzw`
`https://youtu.be/DDwfLImSs0o`