Special and General Relativity (PHZ 4601/5606) Fall 2017 Solutions

Set 3

8. Euclidean and hyperbolic rotations.

Transformation of the 2D Euclidean rotation.

$$\begin{pmatrix} x'^1 \\ i\,x'^0 \end{pmatrix} = \begin{pmatrix} \cosh(\zeta) & i\,\sinh(\zeta) \\ -i\,\sinh(\zeta) & \cosh(\zeta) \end{pmatrix} \begin{pmatrix} x^1 \\ i\,x^0 \end{pmatrix}$$

and in components

$$x'^1 = \cosh(\zeta)\,x^1 - \sinh(\zeta)\,x^0\,,$$
$$i\,x'^0 = -i\,\sinh(\zeta)\,x^1 + i\,\cosh(\zeta)\,x^0\,,$$

or, equivalently,

$$x'^0 = +\cosh(\zeta)\,x^0 - \sinh(\zeta)\,x^1\,,$$
$$x'^1 = -\sinh(\zeta)\,x^0 + \cosh(\zeta)\,x^1\,,$$

$$\begin{pmatrix} x'^0 \\ x'^1 \end{pmatrix} = \begin{pmatrix} \cosh(\zeta) & -\sinh(\zeta) \\ -\sinh(\zeta) & \cosh(\zeta) \end{pmatrix} \begin{pmatrix} x^0 \\ x^1 \end{pmatrix}$$