A is a general 2D linear transformation

$$A = \left\{ \begin{array}{ll} L\left(\boldsymbol{e_u}\right) = & A_{uu}\boldsymbol{e_u} + A_{vu}\boldsymbol{e_v} \\ L\left(\boldsymbol{e_v}\right) = & A_{uv}\boldsymbol{e_u} + A_{vv}\boldsymbol{e_v} \end{array} \right\}$$

$$\det\left(A\right) = A_{uu}A_{vv} - A_{uv}A_{vu}$$

$$\mathrm{Tr}\left(A\right) = \frac{\left(e_u \cdot e_u\right)\left(e_v \cdot e_v\right) A_{uu}}{\left(e_u \cdot e_u\right)\left(e_v \cdot e_v\right) - \left(e_u \cdot e_v\right)^2} + \frac{\left(e_u \cdot e_u\right)\left(e_v \cdot e_v\right) A_{vv}}{\left(e_u \cdot e_u\right)\left(e_v \cdot e_v\right) - \left(e_u \cdot e_v\right)^2} - \frac{\left(e_u \cdot e_v\right)^2 A_{uu}}{\left(e_u \cdot e_u\right)\left(e_v \cdot e_v\right) - \left(e_u \cdot e_v\right)^2} - \frac{\left(e_u \cdot e_v\right)^2 A_{vv}}{\left(e_u \cdot e_u\right)\left(e_v \cdot e_v\right) - \left(e_u \cdot e_v\right)^2}$$

$$B = \left\{ \begin{array}{ll} L\left(\boldsymbol{e_u}\right) = & B_{uu}\boldsymbol{e_u} + B_{vu}\boldsymbol{e_v} \\ L\left(\boldsymbol{e_v}\right) = & B_{uv}\boldsymbol{e_u} + B_{vv}\boldsymbol{e_v} \end{array} \right\}$$

$$A + B = \left\{ \begin{array}{ll} L\left(\boldsymbol{e_u}\right) = & \left(A_{uu} + B_{uu}\right)\boldsymbol{e_u} + \left(A_{vu} + B_{vu}\right)\boldsymbol{e_v} \\ L\left(\boldsymbol{e_v}\right) = & \left(A_{uv} + B_{uv}\right)\boldsymbol{e_u} + \left(A_{vv} + B_{vv}\right)\boldsymbol{e_v} \end{array} \right\}$$

$$AB = \left\{ \begin{array}{ll} L\left(\boldsymbol{e_u}\right) = & \left(A_{uu}B_{uu} + A_{uv}B_{vu}\right)\boldsymbol{e_u} + \left(A_{vu}B_{uu} + A_{vv}B_{vu}\right)\boldsymbol{e_v} \\ L\left(\boldsymbol{e_v}\right) = & \left(A_{uu}B_{uv} + A_{uv}B_{vv}\right)\boldsymbol{e_u} + \left(A_{vu}B_{uv} + A_{vv}B_{vv}\right)\boldsymbol{e_v} \end{array} \right\}$$

$$A - B = \left\{ \begin{array}{ll} L\left(\boldsymbol{e_u}\right) = & \left(A_{uu} - B_{uu}\right)\boldsymbol{e_u} + \left(A_{vu} - B_{vu}\right)\boldsymbol{e_v} \\ L\left(\boldsymbol{e_v}\right) = & \left(A_{uv} - B_{uv}\right)\boldsymbol{e_u} + \left(A_{vv} - B_{vv}\right)\boldsymbol{e_v} \end{array} \right\}$$

$$a \cdot \overline{A}\left(b\right) - b \cdot \underline{A}\left(a\right) = 0$$

T is a linear transformation in Minkowski space

$$\underline{T} = \left\{ \begin{array}{ll} L\left(\boldsymbol{e_t}\right) = & T_{tt}\boldsymbol{e_t} + T_{xt}\boldsymbol{e_x} + T_{yt}\boldsymbol{e_y} + T_{zt}\boldsymbol{e_z} \\ L\left(\boldsymbol{e_x}\right) = & T_{tx}\boldsymbol{e_t} + T_{xx}\boldsymbol{e_x} + T_{yx}\boldsymbol{e_y} + T_{zx}\boldsymbol{e_z} \\ L\left(\boldsymbol{e_y}\right) = & T_{ty}\boldsymbol{e_t} + T_{xy}\boldsymbol{e_x} + T_{yy}\boldsymbol{e_y} + T_{zy}\boldsymbol{e_z} \\ L\left(\boldsymbol{e_z}\right) = & T_{tz}\boldsymbol{e_t} + T_{xz}\boldsymbol{e_x} + T_{yz}\boldsymbol{e_y} + T_{zz}\boldsymbol{e_z} \end{array} \right\}$$

$$\overline{T} = \left\{ \begin{array}{ll} L\left(\boldsymbol{e_t}\right) = & T_{tt}\boldsymbol{e_t} - T_{tx}\boldsymbol{e_x} - T_{ty}\boldsymbol{e_y} - T_{tz}\boldsymbol{e_z} \\ L\left(\boldsymbol{e_x}\right) = & -T_{xt}\boldsymbol{e_t} + T_{xx}\boldsymbol{e_x} + T_{xy}\boldsymbol{e_y} + T_{xz}\boldsymbol{e_z} \\ L\left(\boldsymbol{e_y}\right) = & -T_{yt}\boldsymbol{e_t} + T_{yx}\boldsymbol{e_x} + T_{yy}\boldsymbol{e_y} + T_{yz}\boldsymbol{e_z} \\ L\left(\boldsymbol{e_z}\right) = & -T_{zt}\boldsymbol{e_t} + T_{zx}\boldsymbol{e_x} + T_{zy}\boldsymbol{e_y} + T_{zz}\boldsymbol{e_z} \end{array} \right\}$$

$$\mathrm{tr}\left(\underline{T}\right) = T_{tt} + T_{xx} + T_{yy} + T_{zz}$$

$$a \cdot \overline{T}\left(b\right) - b \cdot \underline{T}\left(a\right) = 0$$