

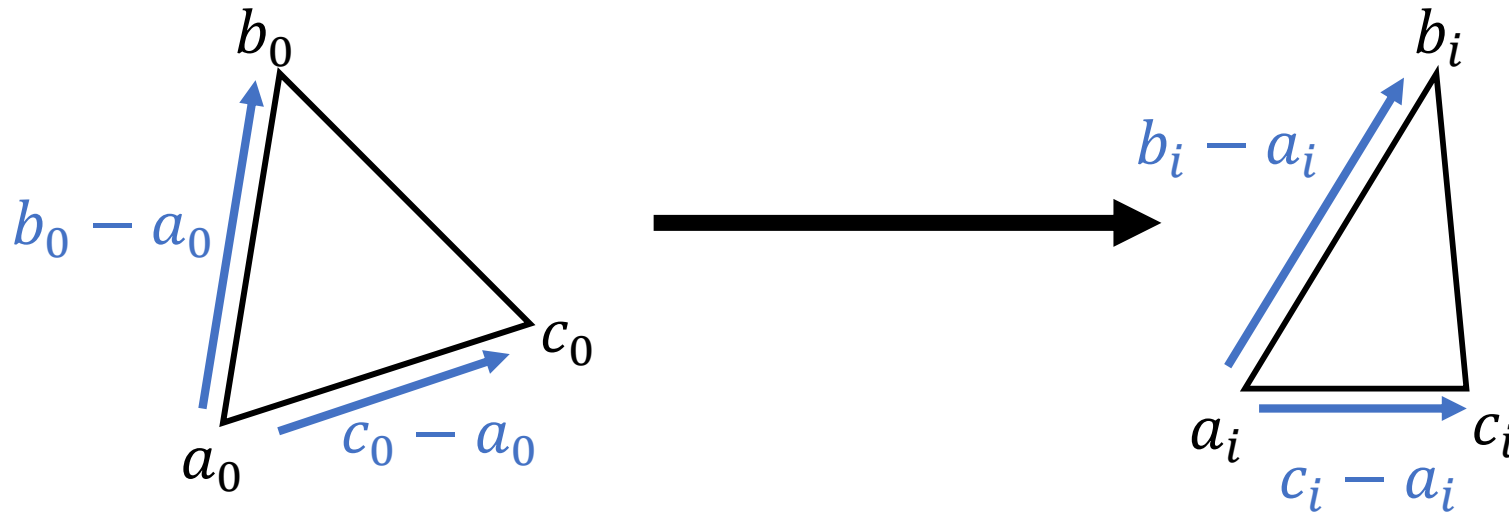
# Jacobian Calculation

## Vertices in 2D



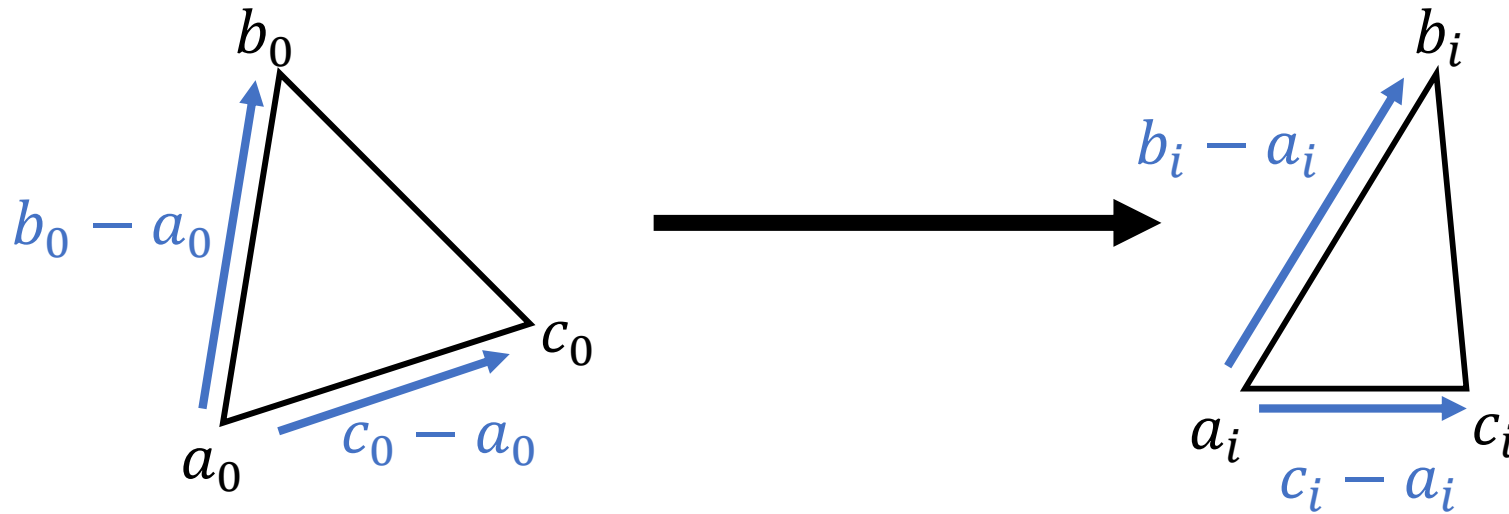
$$\begin{pmatrix} | & | & | \\ a_i & b_i & c_i \\ | & | & | \end{pmatrix}_{2 \times 3} = J_i{}_{2 \times 2} * \begin{pmatrix} | & | & | \\ a_0 & b_0 & c_0 \\ | & | & | \end{pmatrix}_{2 \times 3} + Translate_{2 \times 3}$$

# Vertices in 2D – No translate



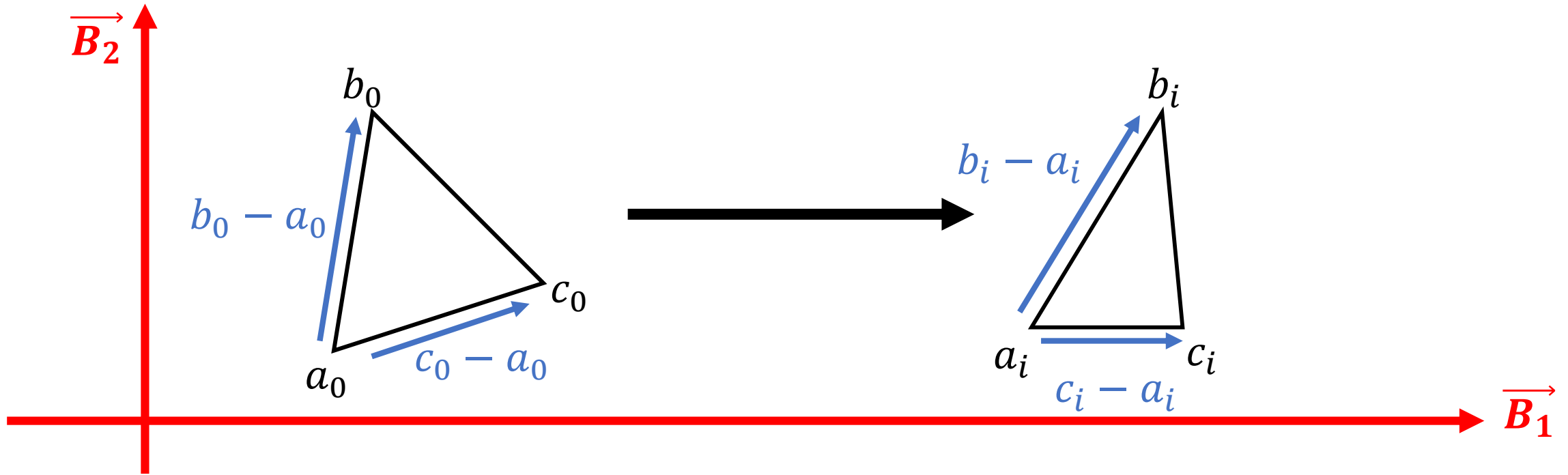
$$\begin{pmatrix} | & | \\ b_i - a_i & c_i - a_i \\ | & | \end{pmatrix}_{2 \times 2} = J_{i \ 2 \times 2} * \begin{pmatrix} | & | \\ b_0 - a_0 & c_0 - a_0 \\ | & | \end{pmatrix}_{2 \times 2}$$

# Vertices in 2D – No translate



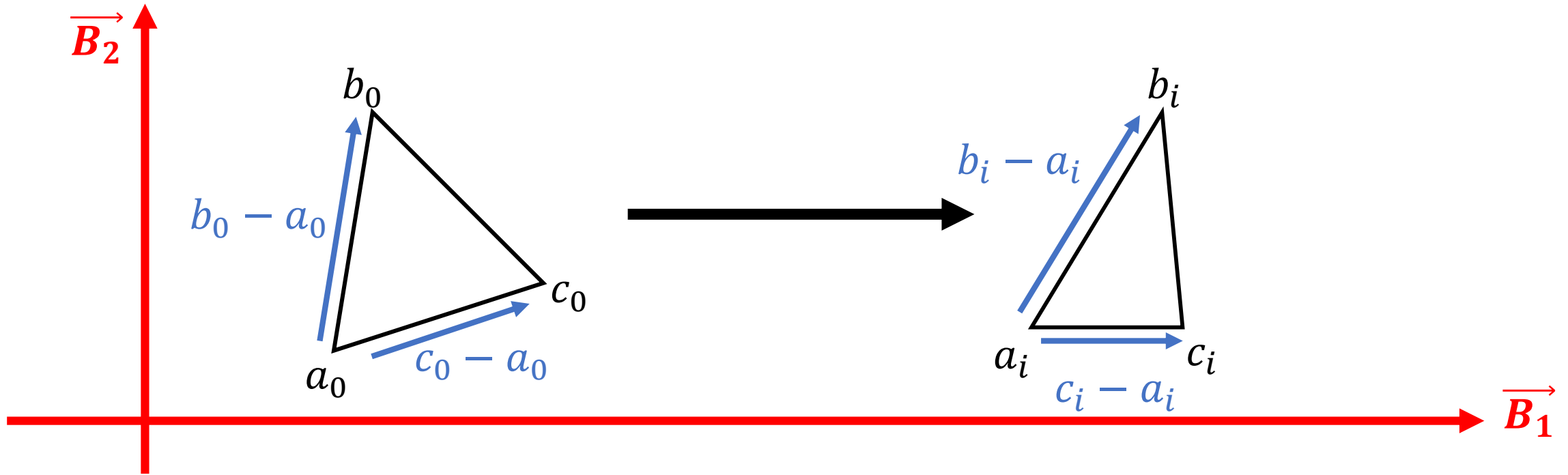
$$J_{i2 \times 2} = \begin{pmatrix} | & | \\ b_i - a_i & c_i - a_i \\ | & | \end{pmatrix}_{2 \times 2} * \begin{pmatrix} | & | \\ b_0 - a_0 & c_0 - a_0 \\ | & | \end{pmatrix}_{2 \times 2}^{-1}$$

# Vertices in 2D – No translate + new x-y axis



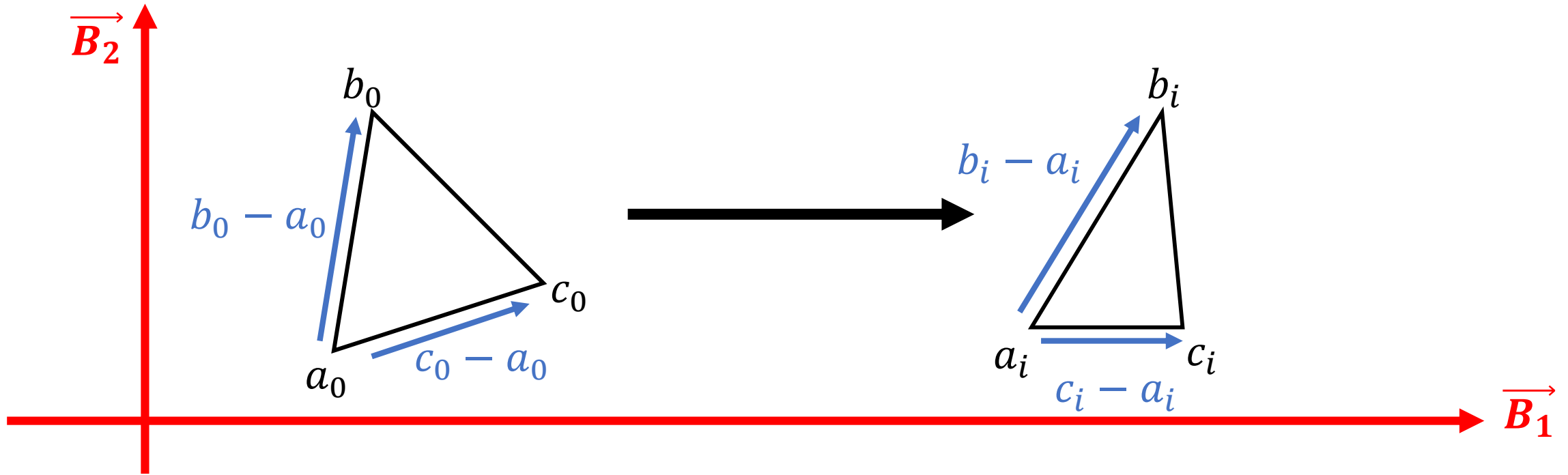
$$\begin{pmatrix} (b_i - a_i)\vec{B}_1 & (c_i - a_i)\vec{B}_1 \\ (b_i - a_i)\vec{B}_2 & (c_i - a_i)\vec{B}_2 \end{pmatrix}_{2 \times 2} = J_{i \ 2 \times 2} * \begin{pmatrix} (b_0 - a_0)\vec{B}_1 & (c_0 - a_0)\vec{B}_1 \\ (b_0 - a_0)\vec{B}_2 & (c_0 - a_0)\vec{B}_2 \end{pmatrix}_{2 \times 2}$$

# Vertices in 2D – No translate + new x-y axis



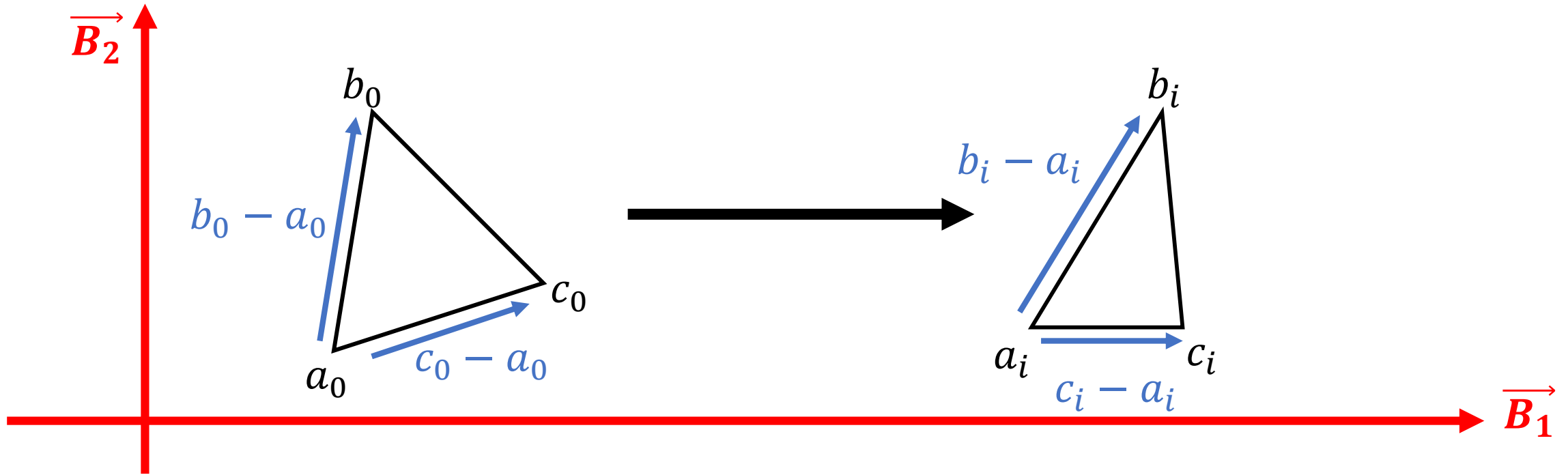
$$J_{i2 \times 2} = \begin{pmatrix} (b_i - a_i) \vec{B}_1 & (c_i - a_i) \vec{B}_1 \\ (b_i - a_i) \vec{B}_2 & (c_i - a_i) \vec{B}_2 \end{pmatrix}_{2 \times 2} \begin{pmatrix} (b_0 - a_0) \vec{B}_1 & (c_0 - a_0) \vec{B}_1 \\ (b_0 - a_0) \vec{B}_2 & (c_0 - a_0) \vec{B}_2 \end{pmatrix}_{2 \times 2}^{-1}$$

# Vertices in 2D – No translate + new x-y axis



$$J_{i2 \times 2} = \begin{pmatrix} (b_i - a_i) \vec{B}_1 & (c_i - a_i) \vec{B}_1 \\ (b_i - a_i) \vec{B}_2 & (c_i - a_i) \vec{B}_2 \end{pmatrix}_{2 \times 2} \begin{pmatrix} (b_0 - a_0) \vec{B}_1 & (c_0 - a_0) \vec{B}_1 \\ (b_0 - a_0) \vec{B}_2 & (c_0 - a_0) \vec{B}_2 \end{pmatrix}_{2 \times 2}^{-1}$$

# Vertices in 2D – No translate + new x-y axis



$$J_{i2 \times 2} = \begin{pmatrix} (b_i - a_i) & (c_i - a_i) \\ (b_i - a_i) & (c_i - a_i) \end{pmatrix}_{2 \times 2} \begin{pmatrix} (b_0 - a_0) \vec{B}_1 & (c_0 - a_0) \vec{B}_1 \\ (b_0 - a_0) \vec{B}_2 & (c_0 - a_0) \vec{B}_2 \end{pmatrix}_{2 \times 2}^{-1}$$