Levi-Civita

$$\varepsilon_{ijk} = \begin{cases} 1, & (i,j,k) \text{ cíclico} \\ -1, & (i,j,k) \text{ anticíclico} \\ 0, & \text{índice repetido} \end{cases}$$

- $\varepsilon^{ijk}\varepsilon_{klm} = \delta^i_k \delta^j_l - \delta^i_l \delta^j_k$; Propriedade

- Considerando $\mathbb{R}^3$, a base $\{e_1, e_2, e_3\}$

$$\det(e_i, e_j, e_k) = \begin{vmatrix} \delta^1_i & \delta^2_j & \delta^3_k \\ \delta^2_i & \delta^2_j & \delta^2_k \\ \delta^3_i & \delta^3_j & \delta^3_k \end{vmatrix} = \varepsilon_{ijk}$$

$$e_1 = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \quad e_2 = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}, \quad e_3 = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

Produto Vetorial entre dois vetores:

$$(\vec{v} \times \vec{w})^k = \varepsilon^k_{ij} v^i w^j$$

componente do prod. vetorial

$$\langle \vec{v} \times \vec{w}, \vec{z} \rangle = \varepsilon_{ijk} v^i w^j z^k$$

- $$\vec{A} \times \vec{B} \times \vec{C} = \varepsilon^{i}_{\ jk}\, \varepsilon^{k}_{\ lm}\, A^{j} B^{l} C^{m}$$

$$= \left(\delta^{i}_{l}\, \delta_{jm} - \delta^{i}_{m}\, \delta_{jl}\right) A^{j} B^{l} C^{m}$$

$$= B^{i}(\vec{A}\cdot\vec{C}) - C^{i}(\vec{A}\cdot\vec{B})$$