Random Notes

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Contents

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1 Coordinate system transformation

Notations:

Local coordinate system is denoted by C_L, and global (world) coordinate system is denoted by C_W.

We define

$$C_L = \begin{pmatrix} e_1 & e_2 & e_3 & 0 \\ & 0 & & 1 \end{pmatrix} \in \mathbb{R}^{4\times 4}, \tag{1}$$

which translates a homogeneous coordinate x_L in C_L to x_W in C_W.

In C_L, we define two transformations (rotation, translation, scaling) $T_1^L, T_2^L \in \mathbb{R}^{4\times 4}$ of **local coordinate system** C_L **w.r.t. global coordinate system** C_W, and T_1 is applied before T_2. It's easy to derive in world space C_W, $T_1^{W\mapsto W} = C_L T_1^L C_L^{-1}$, and this is a mapping from global coordinate to global coordinate. Similarly, $T_1^{L\mapsto W} = T_1^{W\mapsto W} C_L = C_L T_1^L$.

Consider combining these transformations, we have (this time C_L is actually $C_L T_1^L$, because we've moved our local coordinate system)

$$T_2 \circ T_1 \equiv (T_2 \circ T_1)^{L\mapsto W} = (C_L T_1^L) T_2 (C_L T_1^L)^{-1} C_L T_1^L = C_L T_1^L T_2^L. \tag{2}$$

, and to be clear, this mapping is applied on local coordinate system and produce global coordinate.

2 Simple linear elasticity and implementation

References