Frames

Note Title 2015-01-23

Suppose $\underline{\breve{a}}$ is defined with respect to $\underline{\breve{b}}$
w.r.t.

$$\underline{\breve{a}} = \underline{\breve{b}}\,\underline{\bar{A}}$$

Key is to realize that the physical point is the same

$$\boxed{\breve{p} = \underline{\breve{a}}\,\bar{p}' = \underline{\breve{b}}\,\bar{p}}$$

$$\underbrace{\underline{\breve{b}}\,\underline{\bar{A}}}_{\underline{\breve{a}}}\,\bar{p}' = \underline{\breve{b}}\,\bar{p}$$

What does a 4x4 matrix $\underline{\bar{A}}$ do?

transforming $\bar{p}'$ into $\bar{p}$ — View 1

defining a new frame $\underline{\breve{a}}$ — View 2

What do these correspond to in terms of matrix vector multiply

View 1

new x

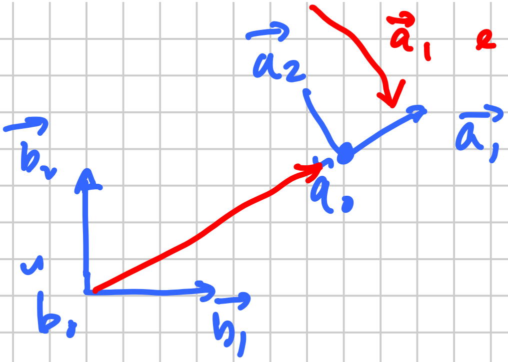
$$\begin{bmatrix} \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

Each row produces a transformed coord. e.g.

View 2

$$\begin{bmatrix} \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

Each column has coordinates of new frame

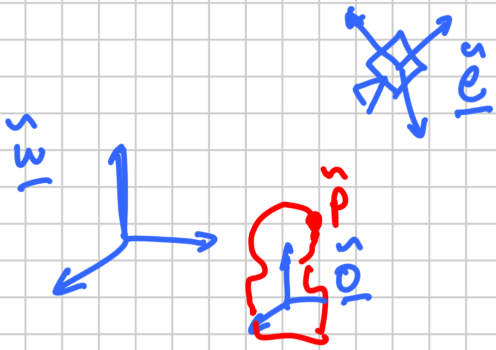


$\vec{a}_1$ expressed w.r.t. $\underline{\breve{b}}$

§ Typical uses of frames (Chapter 5)

World	$\underline{\breve{w}}$	Everything is define w.r.t. $\underline{\breve{w}}$ synonym: Scene
Object or Model	$\underline{\breve{o}}$	Fixed to object. Positions of vertices in .obj file are define wrt $\underline{\breve{o}}$ $\underline{\breve{o}} = \underline{\breve{w}}\,\underline{\overline{O}}$
Eye or View or Camera	$\underline{\breve{e}}$	Fixed to eye/camera $\underline{\breve{e}} = \underline{\breve{w}}\,\underline{\overline{E}}$

To convert from one set of coordinates to another, first convert to a common frame (usually world)



$\breve{p} = \underline{\breve{o}}\,\overline{p}_o = \underline{\breve{w}}\,\underline{\overline{O}}\,\overline{p}_o$ ↖ wrt. object

$\breve{p} = \underline{\breve{e}}\,\overline{p}_e = \underline{\breve{w}}\,\underline{\overline{E}}\,\overline{p}_e$ ↙ w.r.t. eye

Since these are the same physical point $\breve{p}$

$$\underline{\overline{O}}\,\overline{p}_o = \underline{\overline{E}}\,\overline{p}_e$$

$$\overline{p}_e = \underbrace{\underbrace{\underline{\overline{E}}^{-1}}_{\text{view matrix}}\;\underbrace{\underline{\overline{O}}}_{\text{model matrix}}}_{\text{modelView matrix}}\;\overline{p}_o$$

Assignment: a1 NOT assn1