Lecture 9 - Differential Motion Cont.

Monday, April 22, 2013 9:08 AM

Differential Motion continued - Added to lecture 8

$$Rot(x,\theta) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & c & -s \\ 0 & s & c \end{bmatrix}$$

$$Rot(x,\delta x) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -\delta_x \\ 0 & \delta_x & 1 \end{bmatrix}$$

* $\sqrt{1^2 + .01^2} = \sqrt{1.0001} = \sim 1$

when we use differentials $c \Rightarrow 1$ $s \Rightarrow$ angle

* $C_2 C_3 = 1$ $-C_2 S_3 = \delta_z$

* order becomes unimportant w/ differential

$$T + dT = [trans(d_x, d_y, d_z) * Rot(\hat{k}, d\theta)] T$$

factor out T

$$\Rightarrow dT = [[trans] \times [Rot] - I] * T$$

$$\boxed{dT = \Delta \cdot T}$$

differential operator

$$T = \begin{bmatrix} n_x & \cdots & P_x \\ n_y & & P_y \\ & & \vdots \end{bmatrix} \qquad dT = \begin{bmatrix} dn_x & \cdots & dP_x \\ dn_y & & dP_y \\ \vdots & & \vdots \end{bmatrix}$$

* not a frame so okay to have [0, 0, 0, 0]

$$\begin{bmatrix} n_y & & p_y \\ \vdots & & \vdots \\ & & \end{bmatrix} \qquad \begin{bmatrix} dn_y & & & dp_y \\ \vdots & & & \vdots \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

[0, 0, 0, 0]

transformation

$$\Delta = \begin{bmatrix} 1 & 0 & 0 & dx \\ 0 & 1 & 0 & dy \\ 0 & 0 & 1 & dz \\ 0 & 0 & 0 & 1 \end{bmatrix} * \begin{bmatrix} 1 & -\delta_z & \delta_y & 0 \\ \delta_z & 1 & -\delta_x & 0 \\ -\delta_y & \delta_x & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \cancel{1}^{\,0} & -\delta_z & \delta_y & d_x \\ \delta_z & \cancel{1}^{\,0} & -\delta_x & d_y \\ -\delta_y & \delta_x & \cancel{1}^{\,0} & d_z \\ 0 & 0 & 0 & \cancel{1}^{\,0} \end{bmatrix}$$

differential operator

$$dT = \Delta \cdot T_{old}$$

$$T_{new} = T_{old} + dT$$