CISC330 - Assignment 3

Drill Bit Tracking Math

x_t, y_t, z_t, ctr_t = orthonormal coordinate system in F_t

⇒ use ctr_m, A_t, B_t, C_t and $x_t\ y_t\ z_t\ ctr_t$ to find the orthonormal coordinate system at ctr_m in F_m ($x_m\ y_m\ z_m\ ctr_m$)

$$\text{Rotation}_{(F_m \to F_t)} = \begin{bmatrix} \text{dot}(x_t, x_m) & \text{dot}(x_t, y_m) & \text{dot}(x_t, z_m) \\ \text{dot}(y_t, x_m) & \text{dot}(y_t, y_m) & \text{dot}(y_t, z_m) \\ \text{dot}(z_t, x_m) & \text{dot}(z_t, y_m) & \text{dot}(z_t, z_m) \end{bmatrix}$$

$\text{newcenter} = \text{Rotation}_{(F_m \to F_t)} * ctr_m$

$\text{translation} = ctr_t - \text{newcenter}$

$\text{transformation matrix}_{(F_m \to F_t)} = [\text{Rotation}_{(F_m \to F_t)} \quad \text{translation}]$
pad w/ [0 0 0 1] on bottom for 4x4 matrix

⇒ use transformation matrix and apply it to T_m and v_m to find T_t and v_t (pad T_m & v_m w/ 1s at bottom to make 4x1 vectors)