RO2102: Dynamics and Simulation

Tanay Srinivasa
U20220086

Final - Project

Problem 42 **Due** : 15 - May - 2025 **Time Spent** : 1 Hour

To Find: (a) $[\vec{r}]_E$ given $\vec{r}$ and $\hat{e}_i$ (b) R_{ij} given $\underline{R}, \hat{e}_i$ (c) R_{ij} given $\hat{e}_i, \hat{e}_j$ (d) r_i^a given R_{ij} and r_i

(e) r_{0i}^a given r_i and R_{ij} (f) r_i given R_{ij} r_j^a (g) r_{0i} given R_{ij} and r_i (h) R_{0ij} given R_{ij}

(i) $[\vec{r}^a]_E$

(a) $[\vec{r}]_E = \begin{bmatrix} \vec{r}\cdot\hat{e}_1 \\ \vec{r}\cdot\hat{e}_2 \\ \vec{r}\cdot\hat{e}_3 \end{bmatrix}$

(b) $R_{ij} = \hat{e}_i \cdot \underline{R} \cdot \hat{e}_j$

(c) $R_{ij} = \hat{e}_i \hat{e}_j$

(d) $r_i^a = R_{ij}\, r_j$

(e) $r_{0i}^a = r_i$

(f) $r_i = R_{ji}\, r_j^a$

(g) $r_{0i} = R_{ji}\, r_j^a$

(h) $R_{0ij} = R_{ik}\, R_{kj}$

(i) $[\vec{r}^a]_E = R_{ij}\, r_j$

$= R_{ij}\, r_{0j}^a$

$= \hat{e}_i \underline{R}\, \hat{e}_j\, r_{0j}^a$

$= \hat{e}_i \underline{R}\, \hat{e}_j\, r_j$

$= \hat{e}_i\, \hat{e}_l \cdot \hat{e}_j\, \hat{e}_j\, r_j$

$= \hat{e}_i\, \hat{e}_l \cdot \hat{e}_j\, \hat{e}_j\, r_{0j}^a$

$= \hat{e}_i\, \hat{e}_l \cdot \hat{e}_j\, \hat{e}_j\, R_{kj}\, r_k^a$