Tutorial Question

Given $M(0.1, -0.2, -0.1)$, $N(-0.2, 0.1, 0.3)$, $P(0.4, 0, 0.1)$. find ...

(a) R_{NM} (b) $R_{NM} \cdot R_{PM}$ (c) Projection of R_{NM} on R_{PM} (d) The angle between R_{NM} & R_{PM}

(a)
$$R_{NM} = R_M - R_N = (0.1, -0.2, -0.1) - (-0.2, 0.1, 0.3) = \boxed{0.3a_x - 0.3a_y - 0.4a_z}$$

(b)
$$R_{PM} = R_M - R_P = (0.1, -0.2, -0.1) - (0.4, 0, 0.1) = -0.3a_x - 0.2a_y - 0.2a_z$$

$$R_{NM} \cdot R_{PM} = (0.3, -0.3, -0.4) \cdot (-0.3, -0.2, -0.2) = (0.3)(-0.3) + (0.3)(0.2) + (0.4)(0.2) = \boxed{0.05}$$

(c)
$$Prg_{R_{PM}} R_{NM} = \frac{R_{NM} \cdot R_{PM}}{R_{PM} \cdot R_{PM}} R_{PM} = \frac{0.05}{(0.3)^2 + (0.2)^2 + (0.2)^2} (-0.3a_x - 0.2a_y - 0.2a_z) = \boxed{-0.088a_x - 0.059a_y - 0.059a_z}$$

(d)
$$R_{NM} \cdot R_{PM} = |R_{NM}||R_{PM}| \cos\theta \Rightarrow \cos\theta = \frac{0.05}{\sqrt{(.3)^2 + (.3)^2 + (.4)^2} \cdot \sqrt{(.3)^2 + (.2)^2 + (.2)^2}} = 0.208 \Rightarrow \boxed{\theta = \cos^{-1}(0.208) = 1.36}$$

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EE2FH4 - matlab Set 1

Exercise

Given $R_1 = a_x + 2a_y + 3a_z$, $R_2 = 3a_x + 2a_y + a_z$. find...

(a) The Dot Product   (b) The Projection of R_1 onto R_2 (c) The angle between R_1 & R_2

(a)
$$R_1 \cdot R_2 = (1,2,3) \cdot (3,2,1) = (1)(3) + (2)(2) + (3)(1) = 3 + 4 + 3 = \boxed{10}$$

(b)
$$\text{Proj}_{R_2} R_1 = \frac{R_2 \cdot R_1}{R_2 \cdot R_2} R_2 = \frac{10}{3^2 + 2^2 + 1^2} 3a_x + 2a_y + a_z = \frac{10}{14}\left[3a_x + 2a_y + a_z\right] = \boxed{\frac{15}{7}a_x + \frac{10}{7}a_y + \frac{10}{14}a_z}$$

(c)
$$R_1 \cdot R_2 = |R_1||R_2|\cos\theta$$

$$\frac{R_1 \cdot R_2}{|R_1||R_2|} = \cos\theta$$

$$\cos\theta = \frac{10}{\sqrt{3^2 + 2^2 + 1^2} \cdot \sqrt{1^2 + 2^2 + 3^2}}$$

$$\cos\theta = \frac{5}{7}$$

$$\theta = \arccos\left(\frac{5}{7}\right)$$

$$\boxed{\theta = 44.42° = 0.77619 \text{ rad}}$$