

21-S-4-3-AG-063

A force $F = F_x\hat{i} + F_y\hat{j} + F_z\hat{k}$ is applied at a location $d = d_x\hat{i} + d_y\hat{j} + d_z\hat{k}$ away from the point O. Point O and location d are connected by a rigid beam. What is the magnitude of the moment around O?

ANSWER:

We know that a moment can be calculated using,

$$M_O = r \times F$$

Therefore, the moment in Cartesian form can be found using

$$\begin{aligned} \mathbf{d} \times \mathbf{F} &= \langle d_x \quad d_y \quad d_z \rangle \times \langle F_x \quad F_y \quad F_z \rangle = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ d_x & d_y & d_z \\ F_x & F_y & F_z \end{vmatrix} \\ &= (A_y \cdot B_z - A_z \cdot B_y)\hat{i} - (A_x \cdot B_z - A_z \cdot B_x)\hat{j} + (A_x \cdot B_y - A_y \cdot B_x)\hat{k} \end{aligned}$$