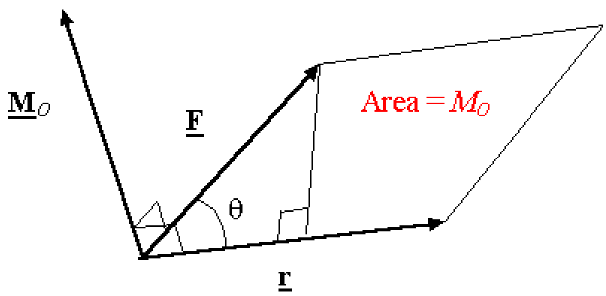
Forces and Moments: Part 2

Calculating the moment using rectangular components:

The moment of a force F about the axis passing through point O and perpendicular to the plane containing O and F can be expressed using the cross product:

$\boldsymbol{M_o} = \boldsymbol{r} \; x \; \boldsymbol{F}$

The magnitude of the moment is the area shown below:



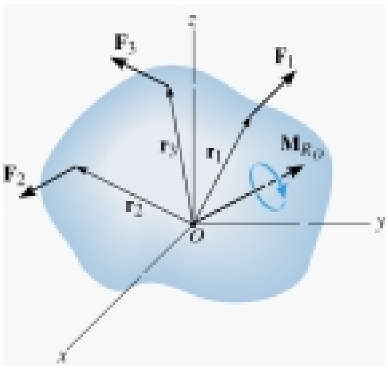
$M_o = | \; r \; x \; F \; | = r \; F \; sin\theta$

$\boldsymbol{r} = x \; \boldsymbol{i} + y \; \boldsymbol{j} + z \; \boldsymbol{k}$

$\boldsymbol{F} = F_x \boldsymbol{i} + F_y \boldsymbol{j} + F_z \boldsymbol{k}$

$$\underline{\mathbf{M}}_O = \underline{\mathbf{r}} \times \underline{\mathbf{F}} = \begin{vmatrix} \underline{\mathbf{i}} & \underline{\mathbf{j}} & \underline{\mathbf{k}} \\ x & y & z \\ F_x & F_y & F_z \end{vmatrix} = (yF_z - zF_y)\underline{\mathbf{i}} - (xF_z - zF_x)\underline{\mathbf{j}} + (xF_y - yF_x)\underline{\mathbf{k}}$$

Resultant moment: $\underline{\mathbf{M}}_{ro}$



$$\underline{\mathbf{M}}_{R_O} = \underline{\mathbf{r}}_1 \times \underline{\mathbf{F}}_1 + \ldots + \underline{\mathbf{r}}_n \times \underline{\mathbf{F}}_n = \sum \underline{\mathbf{r}} \times \underline{\mathbf{F}}$$