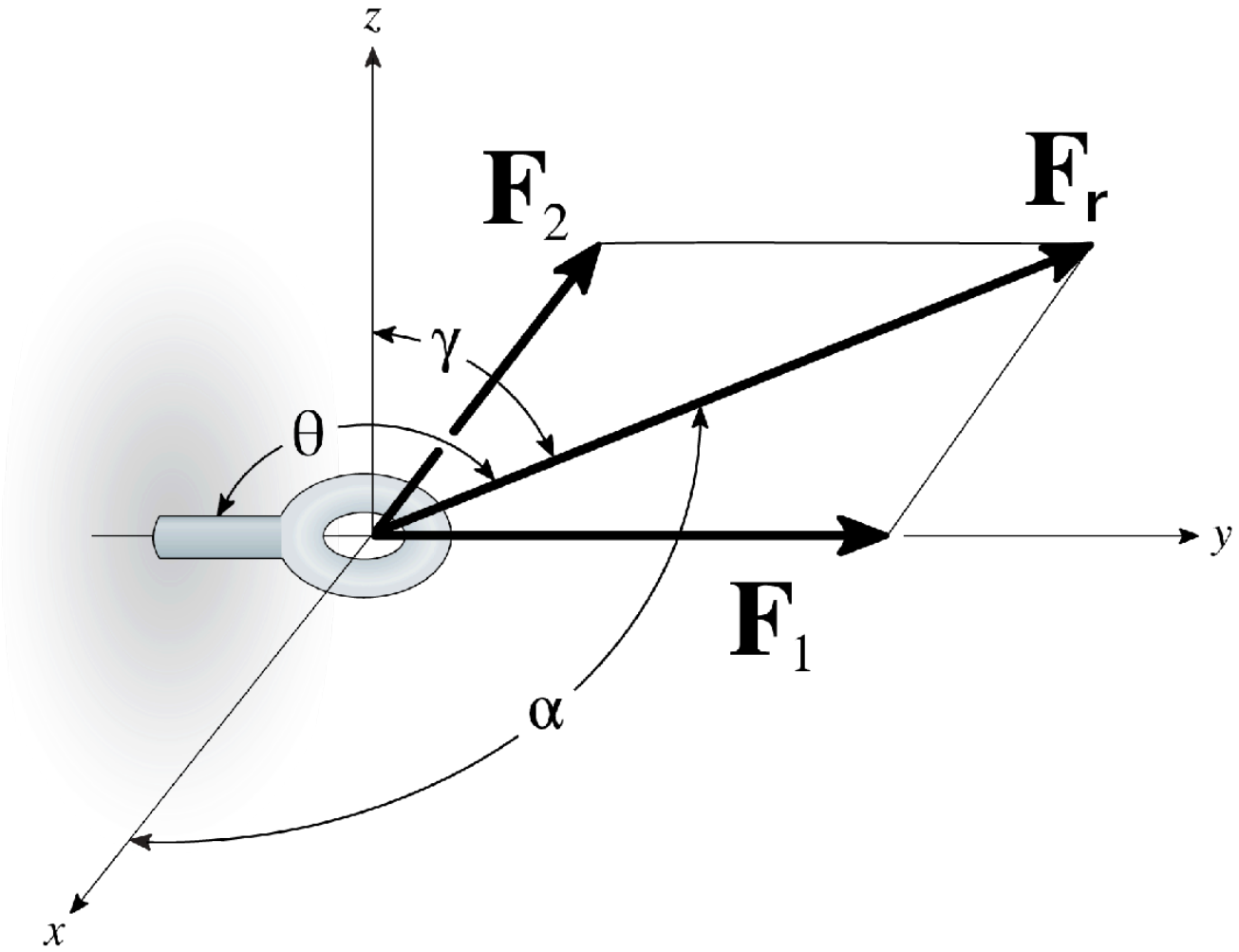

A screw eye is fixed to the wall and supports two forces $\vec{F}_1$ and $\vec{F}_2$. If the resultant force $\vec{F}_r$ has a magnitude of F_R and $\vec{F}_1$ has a magnitude of F_1, find the magnitude and coordinate direction angles of $\vec{F}_2$.

Find γ.

$\beta = 180^\circ - \theta$

$\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$

$\Rightarrow \gamma = \cos^{-1}(\sqrt{1 - \cos^2\alpha - \cos^2\beta})$

Express $\vec{F}_1$ and $\vec{F}_r$ as cartesian vectors.

$\Rightarrow \vec{F}_1 = F_1 \hat{j}$

$\Rightarrow \vec{F}_r = F_r(\cos\alpha \hat{i} + \cos\beta \hat{j} + \cos\gamma \hat{k})$

$F_{rx} = F_r \cos\alpha$

$F_{ry} = F_r \cos\beta$

$F_{rz} = F_r \cos\gamma$

Find the magnitude and coordinate direction angles of $\vec{F}_2$.

$\vec{F}_2 = \vec{F}_r - \vec{F}_1$

$F_{2x} = F_{rx} = F_r \cos\alpha$

$F_{2y} = F_{ry} - F_{1y} = F_r \cos\beta - F_1$

$F_{2z} = F_{rz} = F_r \cos\gamma$

$\Rightarrow F_2 = \sqrt{{F_{2x}}^2 + {F_{2y}}^2 + {F_{2z}}^2}$

$\Rightarrow \alpha_2 = \cos^{-1}\left(\frac{F_{2x}}{F_2}\right)$

$\Rightarrow \beta_2 = \cos^{-1}\left(\frac{F_{2y}}{F_2}\right)$

$\Rightarrow \gamma_2 = \cos^{-1}\left(\frac{F_{2z}}{F_2}\right)$