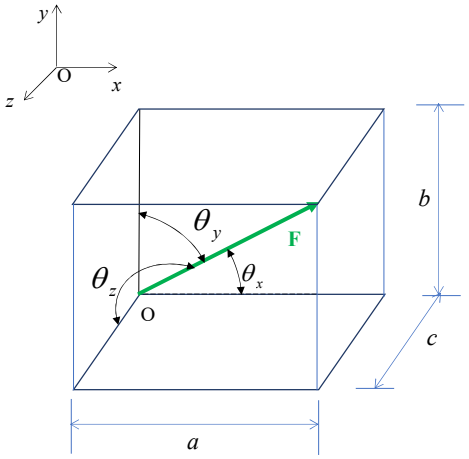
Non-Planar/Spatial/3-D Forces.

Forces in Space



$$\vec{F} = \vec{F}_x + \vec{F}_y + \vec{F}_z$$

$$\vec{F} = F\cos\theta_x + F\cos\theta_y + F\cos\theta_z$$

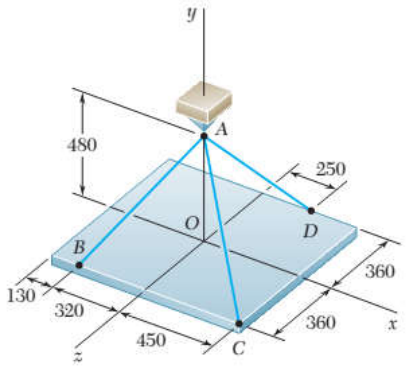
$$\vec{F} = F\lambda = F\left(\frac{a\vec{i} + b\vec{j} + c\vec{k}}{\sqrt{a^2 + b^2 + c^2}}\right)$$

$$= F\vec{i} + F\vec{j} + F\vec{k}$$

Forces in Space

Example

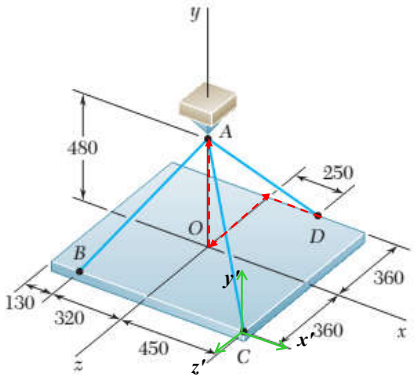
A rectangular plate is supported by three cables as shown. Knowing that the tension in cables AC, AB and AD are 60 N, 80 N and 90 N respectively, determine the components of the forces being exerted at C, B and D.



Dimensions in mm

Forces in Space

Soln



Dimensions in mm

For components of force at D, F_{DA};

$$\vec{DA} = -250i + 480j + 360k$$

$$\lambda_{DA} = \left(\frac{-250\vec{i} + 480\vec{j} + 360\vec{k}}{\left(250^2 + 480^2 + 360^2\right)^{1/2}} \right)$$

$$F_{DA} = 90\left(\frac{-250\vec{i} + 480\vec{j} + 360\vec{k}}{\left(250^2 + 480^2 + 360^2\right)^{1/2}} \right)$$

For components of force at B, F_{BA}

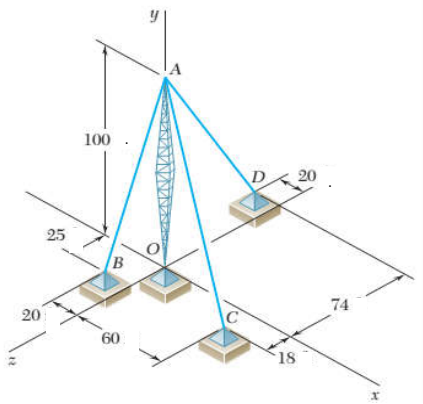
$$\vec{BA} = 320i + 480j - 360k$$

$$\lambda_{BA} =$$

Forces in Space

Example

A transmission tower is held by three guy wired anchored by bolts B, C and D. If the tension in wire AD is 315 N, determine the components of the force exerted by the wire on the bolt at D.

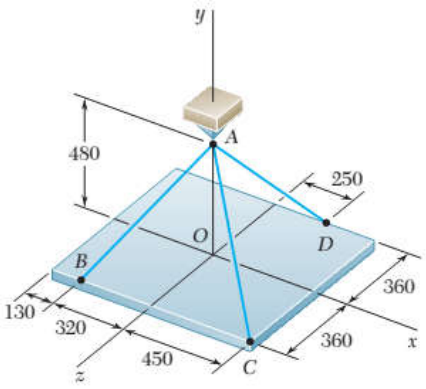


Dimensions are in dm (1 dm = 0.1 m = 10 cm)

Forces in Space

Example

A rectangular plate is supported by three cables as shown. Knowing that the tension in cables AC, AB and AD are 60 N, 80 N and 90 N respectively, determine the magnitude of a force that the three cables are exerting at A.



Dimensions in mm