

ENGINEERING MECHANICS: STATICS



COLLEGE OF
**ENGINEERING, ARCHITECTURE
AND TECHNOLOGY**

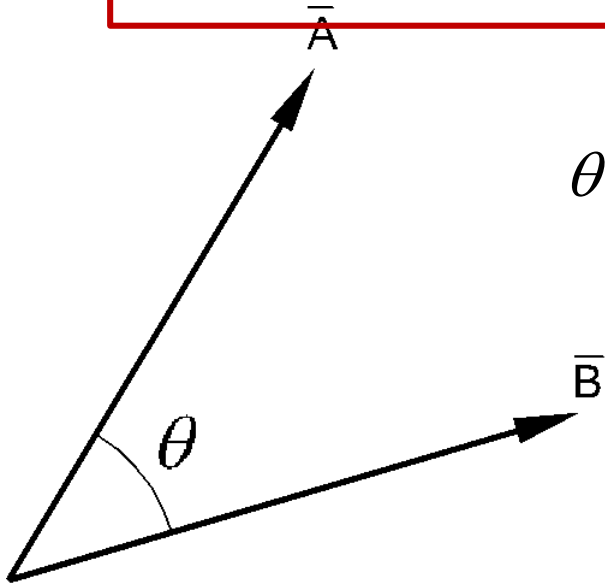


西南交通大学
Southwest Jiaotong University

2.9: Dot Product (Scalar Product):

Dot Product is used to find components of a force parallel and perpendicular to a line. In eqn form:

$$\bar{A} \cdot \bar{B} = |\bar{A}| |\bar{B}| \cos \theta \quad (\text{scalar value})$$



θ = the angle between the vectors, for

$$0^\circ \leq \theta \leq 180^\circ$$

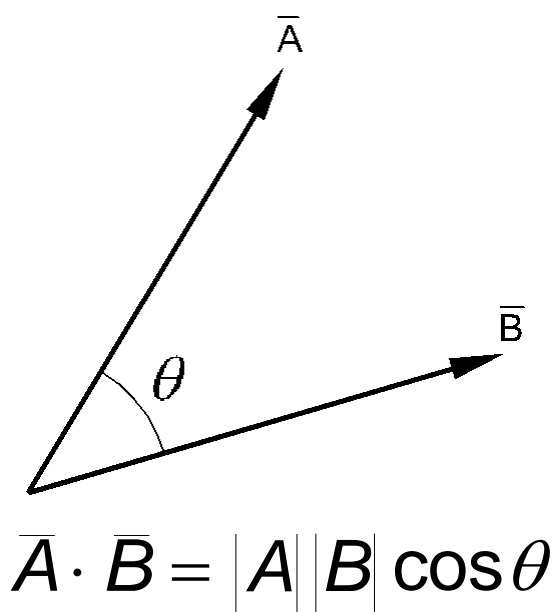
Cartesian Vector Formulation:

For $\theta = 0^\circ$ $\cos 0^\circ = 1$

thus, $i \cdot i = j \cdot j = k \cdot k = 1$

For $\theta = 90^\circ$ $\cos 90^\circ = 0$

thus, $i \cdot j = j \cdot k = k \cdot i = 0$



Application for Dot Product:

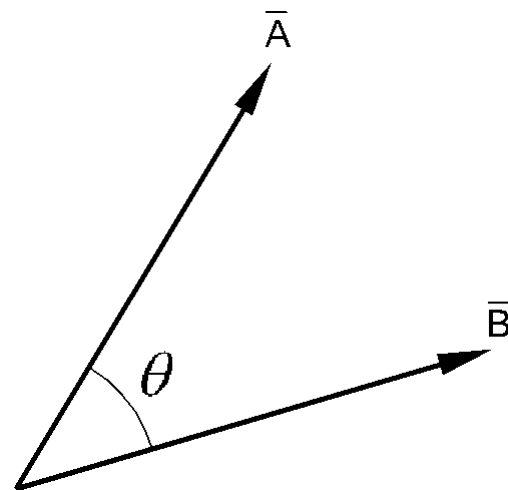
1. Find the angle between two vectors or intersecting lines:

$$\vec{A} \cdot \vec{B} = |\vec{A}| |\vec{B}| \cos \theta$$

$$\cos \theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{A}| |\vec{B}|}$$

$$\theta = \cos^{-1} \left[\frac{\vec{A} \cdot \vec{B}}{|\vec{A}| |\vec{B}|} \right]$$

$$0^\circ \leq \theta \leq 180^\circ$$



2. Find the component of a vector along a line.

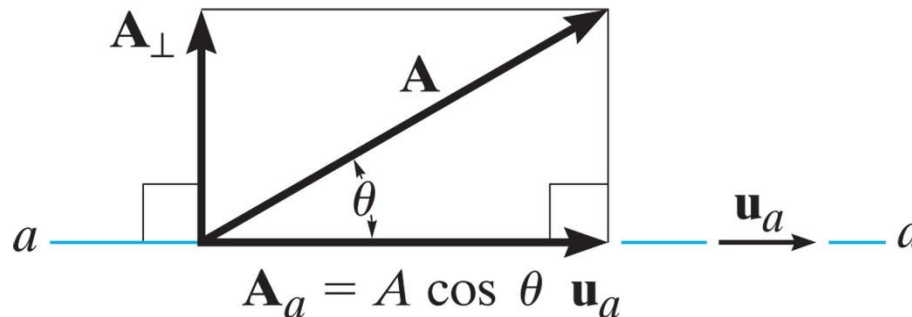
Let $\bar{B} = u$ (unit vector along the line)

$$\bar{A} \cdot u = |A| \cos \theta$$

*This is the **magnitude** of the projection of A on the line defined by u . (magnitude of the component)*

The component of the vector along a line is:

$$\text{Component} = (\bar{A} \cdot u) u$$



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