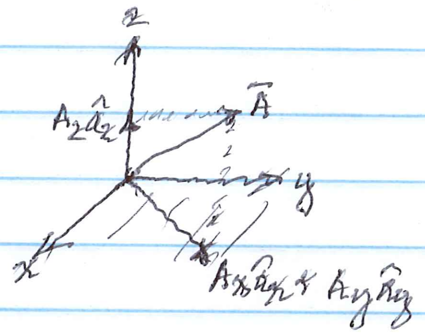
EE 331 – LECT. #16 FEB. 24, 2020

vectors & vector math (cont.)

perpendicular & parallel components of vector

consider $\bar{A} = (A_x, A_y, A_z)$



$$\bar{A} = \bar{A}_{parallel} + \bar{A}_{perpendicular}$$

$$\text{e.g., } \bar{A}_{paral} = A_x\hat{a}_x + A_y\hat{a}_y$$

$$\bar{A}_{perp} = A_z\hat{a}_z$$

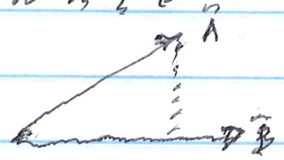
relative to a surf, e.g., xy-plane or shin's knuckle
{parallel = tangential}

note:

$$\bar{A}_{\parallel} = \bar{A} - \bar{A}_{\perp} \quad \text{or} \quad \bar{A}_{\perp} = \bar{A} - \bar{A}_{\parallel}$$

scalar & vector projections – very useful

given 2 vectors $\bar{A}$ & $\bar{B}$



defn: scalar projection (or component) of $\bar{A}$ along $\bar{B}$ is:

$$A_B = \bar{A} \cdot \hat{a}_B = \frac{\bar{A}\cdot\bar{B}}{B} \quad \text{where } \hat{a}_B = \frac{\bar{B}}{B}$$

defn: vector projection (or component) of $\bar{A}$ along $\bar{B}$ is:

$$\bar{A}_B = A_B\,\hat{a}_B = \frac{(\bar{A}\cdot\bar{B})}{B^2}\,\bar{B}$$

→ use to transform vectors to diff coord systems & to find vector components parallel or perpendicular to surf.

position vs distance vectors

defn: position vector always starts at origin & ends on pt in space. it has units of m.

$\bar{r} = (x, y, z)$ m = all space

$\bar{r} = (x, y, 2)$ m = any pt on $z=2$ plane

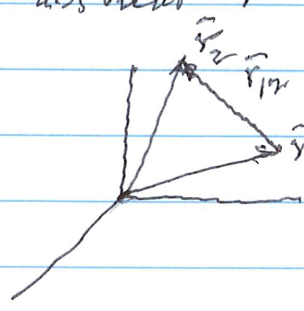
$\bar{r} = (x, 3, 2)$ m = " " " $y=3, z=2$ line

$\bar{r} = (1, 3, 2)$ m = a pt $P(1,3,2)$

defn: distance vector spans 2 pts defined by position vectors

e.g., $\bar{r}_{12} = \underbrace{\bar{r}_2 - \bar{r}_1}_{\text{position vectors}}$ [m] ← points from P_1 to P_2

↑ dist vector



dist btwn P_1 & P_2 is

$|\bar{r}_{12}| = |\bar{r}_{21}|$

$\bar{r}_{12} \neq \bar{r}_{21}$