

$$\bar{a} \quad \bar{a} \times \bar{a} = (\bar{a}_r + j\bar{a}_i) \times (\bar{a}_r + j\bar{a}_i) = j\bar{a}_r \times \bar{a}_i + j\bar{a}_i \times \bar{a}_r = 0$$

$$\bar{a} \times \bar{a}^* = 0 \quad \text{only for LP}$$

$$\bar{b} = \bar{u}_x + j\bar{u}_y \Rightarrow \bar{b} \times \bar{b}^* = (\bar{u}_x + j\bar{u}_y) \times (\bar{u}_x - j\bar{u}_y)$$

$$= -j\bar{u}_x \times \bar{u}_y + j\bar{u}_y \times \bar{u}_x = -2\bar{u}_z j$$

$$\bar{a} \cdot \bar{a} = 0 \quad \text{CP}$$

$$(\bar{u}_x + j\bar{u}_y) \cdot (\bar{u}_x + j\bar{u}_y) = 1 - 1 = 0$$

$$\bar{a} \cdot \bar{a}^* = |\bar{a}|^2$$

$$(\bar{a}_r + j\bar{a}_i) \cdot (\bar{a}_r - j\bar{a}_i) = \bar{a}_r \cdot \bar{a}_r + \bar{a}_i \cdot \bar{a}_i$$

$$= |\bar{a}_r|^2 + |\bar{a}_i|^2$$

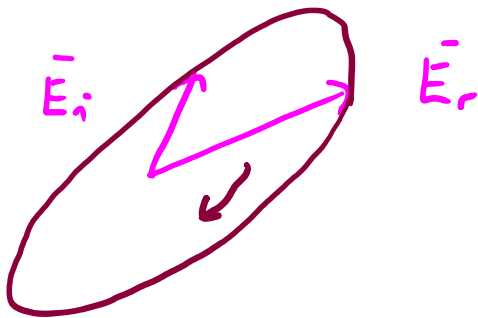
$$\bar{b} = \bar{F}_1 \times (\bar{F}_1 \times \bar{F}_2)$$

$$\bar{b} \cdot \bar{F}(t) = \downarrow \cdot (\bar{F}_1 \cos \omega t + \bar{F}_2 \sin \omega t)$$

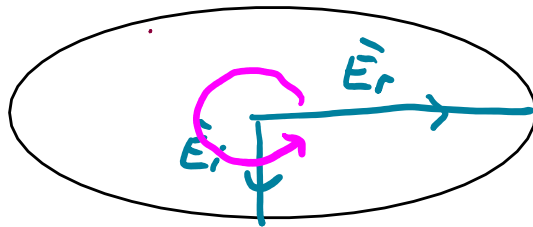
$$= \bar{F}_1 \times (\bar{F}_1 \times \bar{F}_2) \cdot \bar{F}_2 \sin \omega t$$

$$= - (\bar{F}_1 \times \bar{F}_2) \cdot (\bar{F}_1 \times \bar{F}_2) \sin \omega t$$

$$\begin{aligned} \bar{a} \cdot \bar{b} \times \bar{a} &= - \bar{a} \cdot \bar{a} \times \bar{b} \\ &= - \underbrace{\bar{a} \times \bar{a}} \cdot \bar{b} \end{aligned}$$



$$\begin{aligned} \bar{E}(t) &= \bar{E}_r \cos \omega t \\ &\quad - \bar{E}_i \sin \omega t \end{aligned}$$



$$\bar{a} = \bar{u}_x \quad |\bar{a}|^2 = 1$$

$$\bar{b} = j\bar{u}_x + 2\bar{u}_y$$

$$\bar{a} \cdot \bar{b} = j$$

$$\bar{a} \times \bar{b} = 2\bar{u}_z$$

$$\bar{a} \times \bar{b}^* = 2\bar{u}_z$$

$$|\bar{b}|^2 = 5 \rightarrow$$

$$|\bar{a} \cdot \bar{b}|^2 = 1 \quad \left. \vphantom{|\bar{a} \cdot \bar{b}|^2} \right\}^+$$

$$|\bar{a} \times \bar{b}|^2 = 4$$

$$\bar{a} = \bar{u}_x + j\bar{u}_y$$

$$\bar{b} = i\bar{u}_x + 2\bar{u}_y + \bar{u}_z$$

$$|\bar{a}|^2 = 2$$

$$|\bar{b}|^2 = 6$$

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$$\bar{b} = j\bar{u}_x + 2\bar{u}_y + \bar{u}_z \quad |\bar{b}|^2 = 6 \quad \neq$$

$$\bar{a} \cdot \bar{b} = j + 2j \quad |\bar{a} \cdot \bar{b}|^2 = 9 \quad \left. \begin{array}{l} \\ \end{array} \right\} 20$$

$$\bar{a} \times \bar{b} = 2\bar{u}_z - \bar{u}_y + \bar{u}_z + j\bar{u}_x \quad |\bar{a} \times \bar{b}|^2 = 11$$

$$\bar{a} \cdot \bar{b}^* = j \quad |\bar{a} \cdot \bar{b}^*|^2 = 1$$

$$\left. \begin{array}{l} \\ \\ \end{array} \right\} 12$$

$$\bar{a} \times \bar{b}^* = 2\bar{u}_z - \bar{u}_y - \bar{u}_z + j\bar{u}_x$$

$$|\bar{a} \times \bar{b}^*|^2 = 3$$

$$\bar{a}^* \cdot \bar{b} = (\bar{u}_x - j\bar{u}_y) \cdot (j\bar{u}_x + 2\bar{u}_y + \bar{u}_z)$$

$$= j - 2j = -j \quad |\bar{a}^* \cdot \bar{b}|^2 = 1$$

$$\bar{a} \times \bar{b} = 0 \quad \& \quad \bar{a} \cdot \bar{b}^* = 0$$

$$|\bar{a}| \neq 0$$

$$\bar{a} \times \bar{b} = 0 \quad (1.17) \quad \Rightarrow \quad \bar{b} = \alpha \bar{a}$$

$$\bar{a} \cdot (\alpha \bar{a})^* = \bar{a} \cdot \alpha^* \bar{a}^* = \alpha^* |\bar{a}|^2$$

$$\begin{aligned} &\uparrow \\ &= 0 \Rightarrow \alpha = 0 \\ &\Rightarrow \bar{b} = 0 \end{aligned}$$

$$\bar{a} \cdot \bar{b} = 0 \quad \Rightarrow \quad \bar{b} = \bar{c} \times \bar{a}$$



$$j \bar{a} \times \bar{a}^*$$

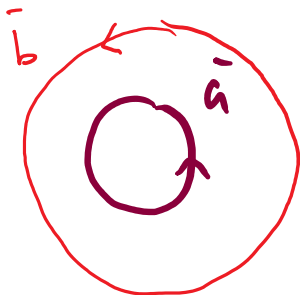
$$= j (\bar{a}_r + j \bar{a}_i) \times (\bar{a}_r - j \bar{a}_i)$$

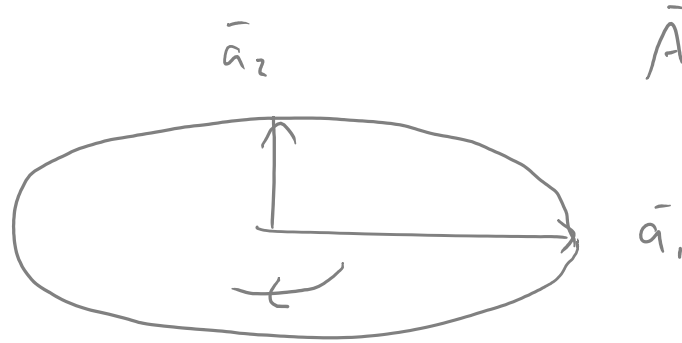
$$= j (-\bar{a}_r \times \bar{a}_i j + j \bar{a}_i \times \bar{a}_r)$$

$$= j (-2j \bar{a}_r \times \bar{a}_i) = 2 \bar{a}_r \times \bar{a}_i$$

$$\alpha \bar{n}$$

$$(\bar{u}_x + j \bar{u}_y) \cdot (\bar{u}_x + j \bar{u}_y) = 0$$





$$\bar{A} = \bar{a}_1 + j\bar{a}_2$$

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 $\bar{a}_1 \cdot \bar{a}_2 = 0$

$$\bar{A}(t) = \bar{a}_1 \cos \omega t - \bar{a}_2 \sin \omega t$$

$$\bar{a} \cdot \bar{b} = 0$$

$$\bar{a} \cdot \bar{b}^* = 0$$

$$\underbrace{\bar{a} \times (\bar{b} \times \bar{b}^*)}_{=0} = \bar{b} \underbrace{(\bar{a} \cdot \bar{b}^*)}_{=0} - \bar{b}^* \underbrace{(\bar{a} \cdot \bar{b})}_{=0}$$

$$\bar{b} \times \bar{b}^* = LP \Rightarrow \bar{a} = LP$$



$$\bar{k} \cdot \bar{r} = \cancel{k \cos \theta}$$