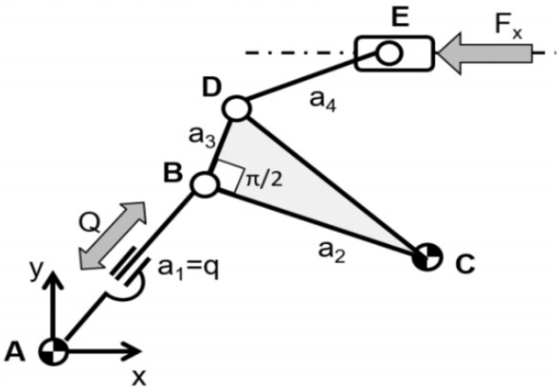
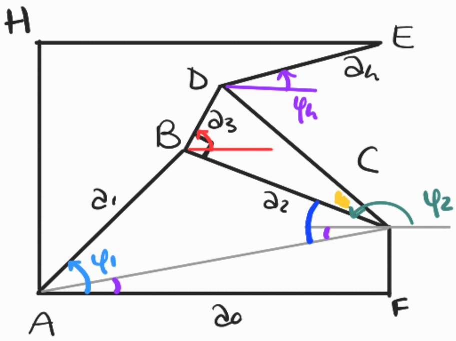
Dati numerici. Detta k l'ultima cifra del numero di matricola, i dati del problema sono:

q=a1 =200+10k mm
qdot = 100 mm/s
xC = 280 mm
a2=BC= 180 mm
yC = 70 mm
a3=BD= 90 mm
yE = 320 mm
a4=DE= 220 mm
l'angolo in B della biella è retto
Fx = 200 + 50k N (orientata verso sinistra)



$k=5$



$a_1 = q = 250$
$a_2 = 180$
$a_3 = 90$
$a_4 = 220$

$y_E = 320$

$$C \begin{cases} x_C = 280 \\ y_C = 70 \end{cases}$$

$$\overline{AC} = \sqrt{x_C^2 + y_C^2} = 288{,}6$$

$$C\hat{A}F = \operatorname{arctg}\left(\frac{y_C}{x_C}\right) = 14{,}03^\circ$$

$$B\hat{A}C = \arccos\left(\frac{a_1^2 + AC^2 - a_2^2}{2 \cdot a_1 \cdot AC}\right) = 38{,}2^\circ$$

$$\varphi_1 = B\hat{A}C + C\hat{A}F = 52{,}2^\circ$$

$$B \begin{cases} x_B = a_1 \cos\varphi_1 = 153{,}22 \text{ mm} \\ y_B = a_1 \sin\varphi_1 = 197{,}5 \text{ mm} \end{cases}$$

$$A\hat{C}B = \arccos\left(\frac{a_2^2 + AC^2 - a_1^2}{2 a_2 AC}\right) = 59{,}2^\circ$$

$$B\hat{C}D = \operatorname{arctg}\left(\frac{a_3}{a_2}\right) = 26{,}56^\circ$$

$$\varphi_2 = 180^\circ - A\hat{C}B + C\hat{A}F = 134{,}8^\circ$$

$$\varphi_3 = \varphi_2 - 90^\circ = 44{,}8^\circ$$

$$D \begin{cases} x_D = x_B + a_3 \cos\varphi_3 = 217{,}08 \text{ mm} \\ y_D = y_B + a_3 \sin\varphi_3 = 260{,}91 \text{ mm} \end{cases}$$

$$x_E - x_D = a_4 \cos\varphi_4$$

$$\varphi_4 = \arcsin\left(\frac{y_E - y_D}{a_4}\right) = 15{,}5°$$

$$x_E = x_D + a_4 \cos\varphi_4 = 428{,}9 \text{ mm}$$

MAGLIA AFCB

$$\begin{cases} a_0 + a_2\cos\varphi_2 - a_1\cos\varphi_1 = 0 \\ a_6 + a_2\sin\varphi_2 - a_1\sin\varphi_1 = 0 \end{cases}$$

$$\begin{cases} -a_2\sin\varphi_2\cdot\dot\varphi_2 - \dot a_1\cos\varphi_1 + a_1\sin\varphi_1\cdot\dot\varphi_1 = 0 \\ a_2\cos\varphi_2\cdot\dot\varphi_2 - \dot a_1\sin\varphi_1 - a_1\cos\varphi_1\cdot\dot\varphi_1 = 0 \end{cases}$$

$$\begin{bmatrix} -a_2\sin\varphi_2 & a_1\sin\varphi_1 \\ a_2\cos\varphi_2 & -a_1\cos\varphi_1 \end{bmatrix}\begin{Bmatrix}\dot\varphi_2 \\ \dot\varphi_1\end{Bmatrix} = \begin{Bmatrix}\cos\varphi_1 \\ \sin\varphi_1\end{Bmatrix}\dot a_1$$

$$\begin{Bmatrix}\dot\varphi_2 \\ \dot\varphi_1\end{Bmatrix} = \frac{1}{a_1a_2\sin(\varphi_2-\varphi_1)}\begin{bmatrix} -a_1\cos\varphi_1 & -a_1\sin\varphi_1 \\ -a_2\cos\varphi_2 & -a_2\sin\varphi_2 \end{bmatrix}\begin{Bmatrix}\cos\varphi_1 \\ \sin\varphi_1\end{Bmatrix}\dot a_1$$

$$\begin{Bmatrix}\dot\varphi_2 \\ \dot\varphi_1\end{Bmatrix} = \frac{1}{a_1a_2\sin(\varphi_2-\varphi_1)}\begin{bmatrix} -a_1\cos\varphi_1\cos\varphi_1 - a_1\sin\varphi_1\sin\varphi_1 \\ -a_2\cos\varphi_2\cos\varphi_1 - a_2\sin\varphi_2\sin\varphi_1 \end{bmatrix}\dot a_1$$

$$\dot\varphi_2 = \frac{-a_1}{a_1a_2\sin(\varphi_2-\varphi_1)}\dot a_1 = \frac{-100}{180\sin(134{,}8-52{,}2)} = -32\ \frac{deg}{s} = \dot\varphi_3$$

$$\dot\varphi_1 = \frac{-a_2\cos(\varphi_2-\varphi_1)}{a_1a_2\sin(\varphi_2-\varphi_1)}\dot a_1 = \frac{-\cos(134{,}8-52{,}2)\cdot 100}{250\sin(134{,}8-52{,}2)} = -2{,}97\ \frac{deg}{s}$$

MAGLIA ABDEH

$$\begin{cases} a_1\cos\varphi_1 + a_3\cos\varphi_3 + a_4\cos\varphi_4 - x_E = 0 \\ a_1\sin\varphi_1 + a_3\sin\varphi_3 + a_4\sin\varphi_4 - y_E = 0 \end{cases}$$

$$\begin{cases} -a_1\sin\varphi_1\cdot\dot\varphi_1 - a_3\sin\varphi_3\cdot\dot\varphi_3 - a_4\sin\varphi_4\cdot\dot\varphi_4 - \dot x_E = -\dot a_1\cos\varphi_1 \\ a_1\cos\varphi_1\cdot\dot\varphi_1 + a_3\cos\varphi_3\cdot\dot\varphi_3 + a_4\cos\varphi_4\cdot\dot\varphi_4 = -\dot a_1\sin\varphi_1 \end{cases}$$

$$\begin{cases} -a_4\sin\varphi_4\cdot\dot\varphi_4 - \dot x_E = -\dot a_1\cos\varphi_1 + a_1\sin\varphi_1\cdot\dot\varphi_1 + a_3\sin\varphi_3\cdot\dot\varphi_2 \\ +a_4\cos\varphi_4\cdot\dot\varphi_4 = -\dot a_1\sin\varphi_1 - a_1\cos\varphi_1\cdot\dot\varphi_1 - a_3\cos\varphi_3\cdot\dot\varphi_2 \end{cases}$$

$$\dot{\varphi}_4 = \frac{-\dot{a}_1 \sin\varphi_1 - a_1 \cos\varphi_1 \cdot \dot{\varphi}_1 - a_3 \cos\varphi_3 \cdot \dot{\varphi}_2}{+ a_4 \cos\varphi_4} = -9{,}5 \ \frac{deg}{s}$$

$$x_E = a_1 \cos\varphi_1 + a_3 \cos\varphi_3 + a_4 \cos\varphi_4$$

$$\dot{x}_E = \dot{a}_1 \cos\varphi_1 - a_1 \sin\varphi_1 \cdot \dot{\varphi}_1 - a_3 \sin\varphi_3 \cdot \dot{\varphi}_2 - a_4 \sin\varphi_4 \cdot \dot{\varphi}_4 = 117{,}4 \ \frac{mm}{s} \sim 117$$

ANALISI STATICA

$$-F_x \cdot \dot{x}_E + Q \cdot \dot{a}_1 = 0$$

$$F_x = 450 \ N$$

$$Q = \frac{F_x \dot{x}_E}{\dot{a}_1} = \frac{450 N \cdot 117 \frac{mm}{s}}{100 \ \frac{mm}{s}} = 526{,}5 N$$