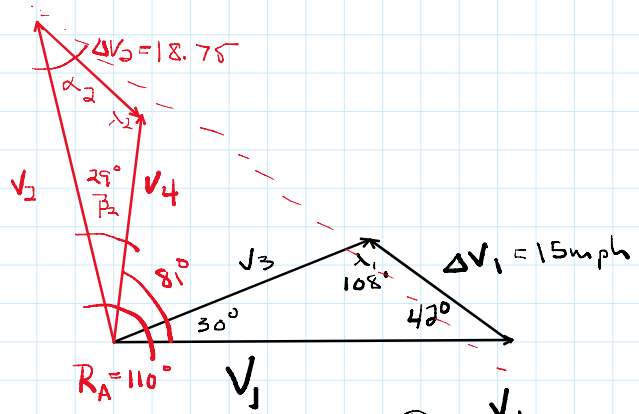
Test Review

Friday, October 25, 2024 7:11 AM

Triangle Velocity Solutions



$W_1 = 5000$ lbs
App $= 0°$
$\Theta = 30°$
$\Delta V_1 = 15$ mph
$\alpha_1 = 42°$

$W_2 = 4000$ lbs
$\psi = 110°$
$\phi = 81°$

① Solve for λ_1

$\lambda_1 = 180 - 30 - 42$

$\lambda_1 = 108$

② $\dfrac{V_1}{\sin\lambda_1} = \dfrac{\Delta V_1}{\sin\Theta}$

$\dfrac{V_1}{\sin(108)} = \dfrac{15}{\sin(30)}$

$\dfrac{V_1}{0.9511} = \dfrac{15}{0.5}$

$V_1 = (0.9511)(30)$

$V_1 = 28.5$ mph

③ $\dfrac{V_3}{\sin\alpha_1} = \dfrac{\Delta V_1}{\sin\Theta}$

$\dfrac{V_3}{\sin(42)} = \dfrac{15}{\sin(30)}$

$\dfrac{V_3}{0.6691} = \dfrac{15}{0.5}$

$V_3 = (0.6691)(30)$

$V_3 = 20.07$ mph

④ Calculate β_2

$\beta_2 = 110 - 81$

$\beta_2 = 29°$

⑤ Calculate ΔV_2

$\Delta V_2 = \Delta V_1\left(\dfrac{W_1}{W_2}\right)$

$\Delta V_2 = (15)\left(\dfrac{5000}{4000}\right)$

$\Delta V_2 = (15)(1.25)$

$\Delta V_2 = 18.75$ mph

⑥ Calculate α_2

$\alpha_2 = 180 - 110 - 42$

$\alpha_2 = 28°$

⑦ Calculate λ_2

$\lambda_2 = 180 - \alpha_2 - \beta_2$

$\lambda_2 = 180 - 28 - 29$

$\lambda_2 = 123°$

⑧ $\dfrac{V_2}{\sin\lambda_2} = \dfrac{\Delta V_2}{\sin\beta_2}$

$\dfrac{V_2}{\sin 123} = \dfrac{18.75}{\sin 29}$

$\dfrac{V_2}{0.8387} = \dfrac{18.75}{0.4848}$

$V_2 = (0.8387)(38.67)$

$V_2 = 32.44$ mph

⑨ $\dfrac{V_4}{\sin\alpha_2} = \dfrac{\Delta V_2}{\sin\beta_2}$

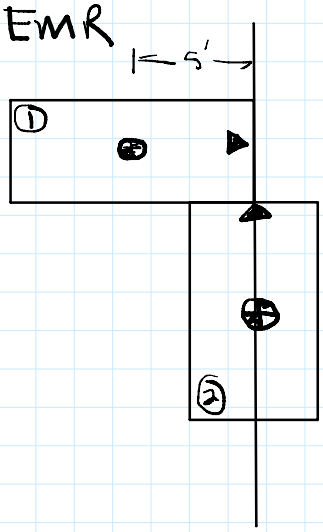
$\dfrac{V_4}{\sin 28°} = \dfrac{18.75}{\sin 29°}$

$\dfrac{V_4}{0.4695} = \dfrac{18.75}{0.4848}$

$V_4 = (0.4695)(38.67)$

$V_4 = 18.15$ mph

EMR



$W_1 = 4700$ $W_2 = 3800$

$h = 5'$ $h = 0$

$e = 0.15$ $\Delta V_2 = -20$

$\Delta V_1 =$ $\gamma_2 = 1$

① Calculate ΔV_1

$$\Delta V_1 = \Delta V_2 \left(\frac{W_2}{W_1}\right)$$

$$\Delta V_1 = (20)\left(\frac{3800}{4700}\right)$$

$$\Delta V_1 = (20)(0.8085)$$

$$\Delta V_1 = 16.17 \text{ mph}$$

② Calculate I_{y1}

$$I_{y_1} = 1.03(W_1) - 1206$$

$$I_{y_1} = 1.03(4700) - 1206$$

$$I_{y_1} = 4841 - 1206$$

$$I_{y_1} = 3635$$

③ Calculate k^2

$$k^2 = \frac{I_{yg}}{W}$$

$$k^2 = \frac{(3635)(32.2)}{4700}$$

$$k^2 = \frac{117047}{4700}$$

$$k^2 = 24.90$$

④ Calculate γ_1

$$\gamma_1 = \frac{k^2}{k^2 + h^2}$$

$$\gamma_1 = \frac{24.9}{24.9 + 5^2}$$

$$\gamma_1 = \frac{24.9}{49.9}$$

$$\gamma_1 = 0.5$$

⑤ Calculate $V_{c,\Delta V}$

$$V_{c,\Delta V} = \left[\frac{1}{1+e}\right]\left[\frac{|\Delta V_1|}{\gamma_1} + \frac{|\Delta V_2|}{\gamma_2}\right]$$

$$V_{c,\Delta V} = \left[\frac{1}{1.15}\right]\left[\frac{16.17}{0.5} + \frac{20}{1}\right]$$

$$V_{c,\Delta V} = (0.8696)(32.34 + 20)$$

$$V_{c,\Delta V} = (0.8696)(52.34)$$

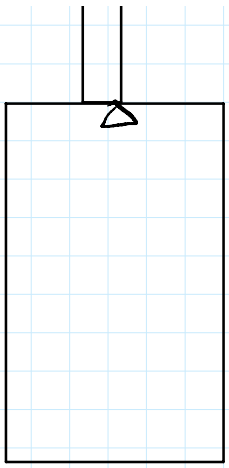
$$V_{c,\Delta V} = 45.51 \text{ mph}$$

GROUND FORCES

$W_c = 4200$ $W_{mc} = 650$

$f = 0.85$

$\Delta V = -11 \text{ mph}$



$\Delta V = -11 mph$

$\Delta t = 0.10 s$

$e = 0.07$

① Calculate ΔV_{adj}

$$\Delta V_{adj} = \frac{fg\Delta t}{1.466}$$

$$\Delta V_{adj} = \frac{(0.85)(32.2)(0.10)}{1.466}$$

$$\Delta V_{adj} = \frac{2.74}{1.466}$$

$$\Delta V_{adj} = 1.87 mph$$

② Calculate ΔV_{corr}

$$\Delta V_{corr} = \Delta V_{EDR} \pm \Delta V_{adj}$$

$$\Delta V_{corr} = -11 + 1.87$$

$$\Delta V_{corr} = -9.13$$

③ Calculate ΔV_{mc}

$$\Delta V_{mc} = \Delta V_{corr}\left(\frac{W_c}{W_{mc}}\right)$$

$$\Delta V_{mc} = (9.13)\left(\frac{4200}{650}\right)$$

$$\Delta V_{mc} = (9.13)(6.46)$$

$$\Delta V_{mc} = 59 mph$$

④ Calculate Closing Vel

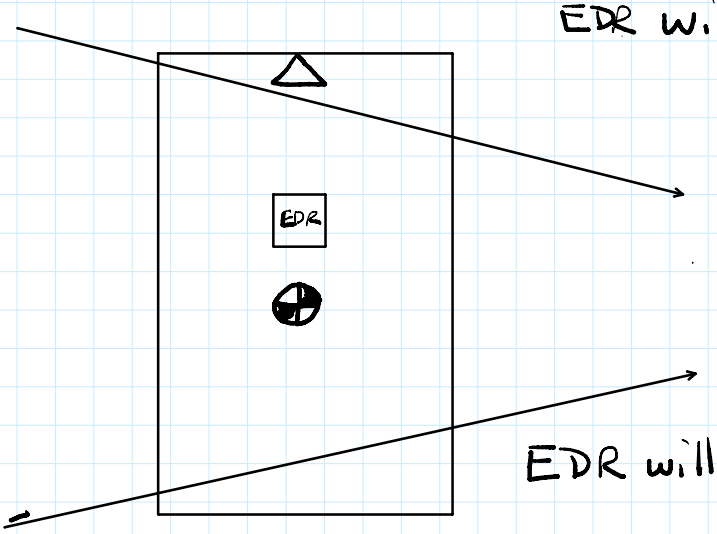
$$V_{c,\Delta V} = \left[\frac{1}{1+e}\right]\left[\frac{|\Delta V_1|}{g_1} + \frac{|\Delta V_2|}{g_2}\right]$$

$$V_{c,\Delta V} = \left[\frac{1}{1.07}\right]\left[(9.13) + (59)\right]$$

$$V_{c,\Delta V} = (0.9346)(68.13)$$

$$V_{c,\Delta V} = 63.67 mph$$

OFF AXIS



EDR will over report ΔV @ COM

EDR will under report ΔV @ COM