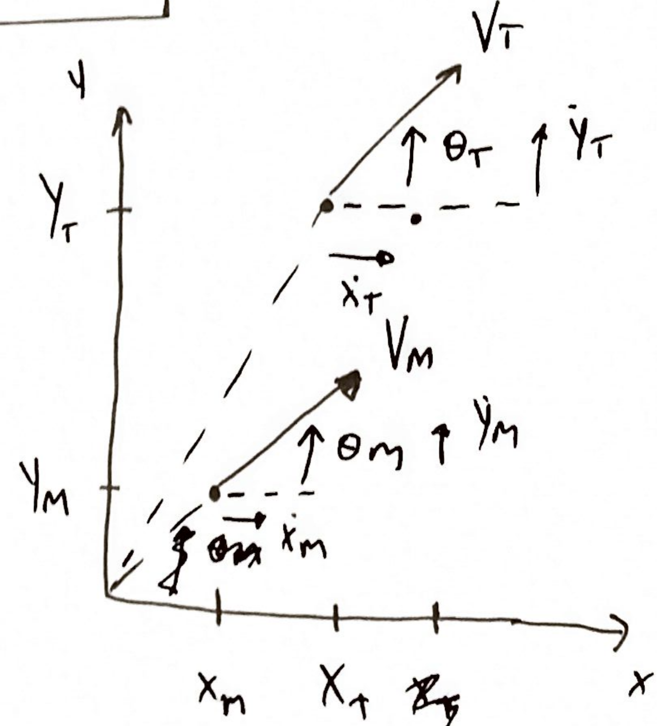
Problem # 5.7

Given:

$$x = X_T - X_M$$
$$y = Y_T - Y_M$$



Find:

Differential Equations for x & y

Solution:

$$\dot{X}_T = V_T \cos(\theta_T) \qquad \dot{Y}_T = V_T \sin(\theta_T)$$

$$\dot{X}_M = V_M \cos(\theta_M) \qquad \dot{Y}_M = V_M \sin(\theta_M)$$

So, the solution is simply

$$\dot{x} = V_T \cos(\theta_T) - V_M \cos(\theta_M)$$
$$\dot{y} = V_T \sin(\theta_T) - V_M \sin(\theta_M)$$

PROBLEM # 5.8

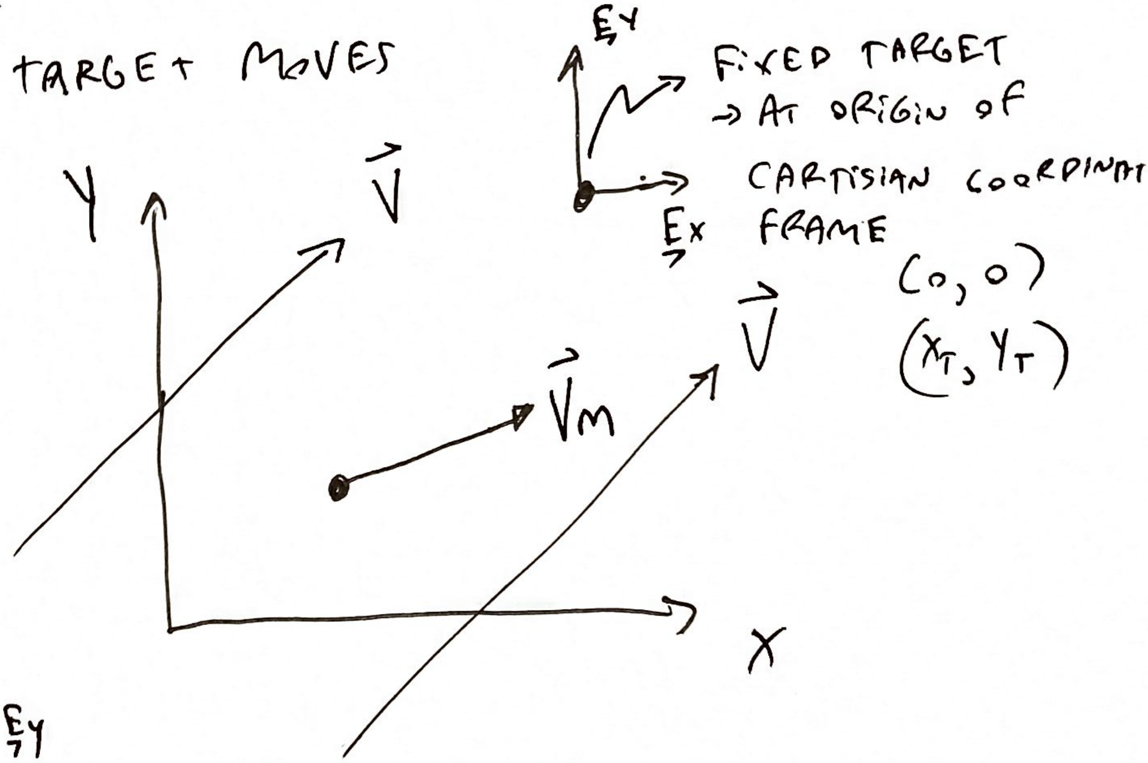
GIVEN

SAME PROBLEM AS 5.7 EXCEP NOW THERE IS A CONSTANT VELOCITY FIELD & TARGET IS FIXED

FIND

SHOW THAT THE EFFECT OF CURRENTS IS THE SAME AS IF THE TARGET MOVES

Solution:



$\vec{V} = V_x \underset{\rightharpoonup}{E}_x + V_y \underset{\rightharpoonup}{E}_y$

$\vec{V}_M = \dot{X}_M \underset{\rightharpoonup}{E}_x + \dot{Y}_M \underset{\rightharpoonup}{E}_y$

AS IN 5.7, WE SUBTRACT AS: $\vec{V}_M - \vec{V}$ AND look AT EACH COMPONENT:

$$\dot{X} = \dot{X}_M - V_x = V_M \cos(\theta_M) - V_x$$

$$\dot{Y} = \dot{Y}_M - V_y = V_M \sin(\theta_M) - V_y$$

PROBLEM # 5.9

GIVEN

$\lambda = 3$

$V_T = 1000 \dfrac{ft}{sec}$

$\beta(0) = 90°$

$V_M = 3000 \dfrac{ft}{sec}$

$R(0) = 2000\ ft$

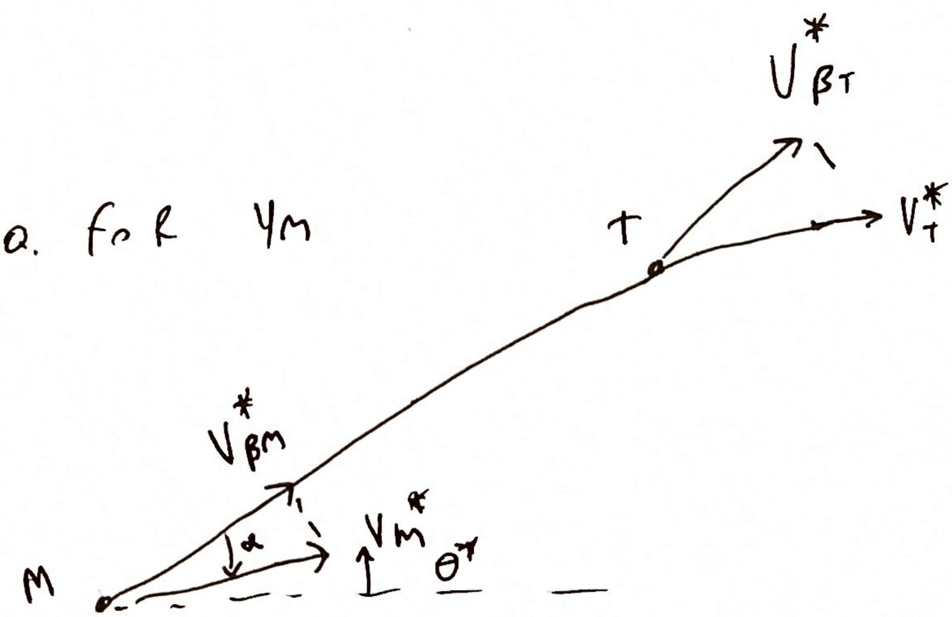
$\theta(t) = 0.01\pi \sin(2\pi t)$

$\theta(0) = 0.4\pi$ RAD

$$Y(s) = \frac{1}{1 + 0.5s}$$

FIND:

LINEARIZED EQ. FOR Y_M



SOLUTION:

$$V^*_{\beta M} = V^*_M \cos(\alpha)$$

$$\Lambda$$

$$D(s)\ \dot{Y}_M = \frac{V^*_{\beta M}\lambda}{\left|V^*_{\beta T} - V^*_{\beta M}\right|} N(s) \left(\frac{Y_T - Y_M}{t^*_f - t}\right)$$

WHERE,

$$t_f^* = \frac{R_0}{\left| V_{\beta T}^* - V_{\beta M}^* \right|}$$