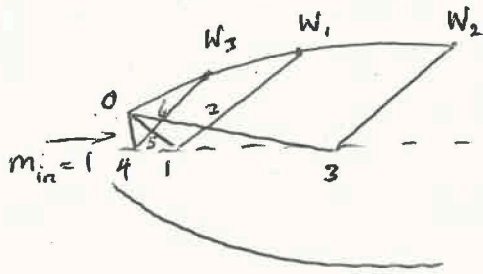


MOC Mach = 2.5

①



$$\theta_w(\max) = \frac{\sqrt{m_e}}{2} = \frac{39.12}{2} = 19.56$$

Point 0

$$M = 1.7565$$

(1.76) ✓

$$\mu = 34.62^\circ$$

$$K_- = 39.12$$

angle of 9.78°

$$m = 1.39$$

$$\mu = 46^\circ \quad K_- = 19.56$$

Table:

point	x	y	θ	U	m	μ	$L^+ \frac{dy}{dx}$	$C^- \frac{dy}{dx}$	k_+	K_-
0(1)	0	1	19.56	19.56	1.76	34.62	-	-	0	39.12
0(2)	0	1	9.78	9.78	1.39	46	-	-	0	19.56

$$K_- = \theta_1 + \theta_2(m) = 19.56, \quad \theta_1 = 0^\circ \quad \therefore \theta_2(m) = 19.56 \quad \text{Point 1}$$

$$m_1 = 1.76, \quad \mu_1 = 34.62$$

$$\frac{y_1 - y_0}{x_1 - x_0} = \tan(\theta_{av} - \mu_{av})$$

$$= \frac{0 - 1}{x_1 - 0} = \tan\left(\frac{9.78 + 0}{2} - \frac{46 + 34.62}{2}\right)$$

$$\frac{-1}{x_1} = \tan(-35.42)$$

$$x_1 = 1.406$$

(2)

point	x	y	θ	V	M	M	$c+dg/dx$	$c-dy/dx$	K_+	K_-
0(1)	0	1	19.56	19.56	1.76	34.62	-	-	0	39.12
0(2)	0	1	9.78	9.78	1.39	46	-	-	0	19.56
1	1.406	0	0	19.56	1.76	34.62	-	-0.711	-19.56	19.56

Intersection of 2 known lines:

K_- line from point (0) (originating at $\theta = 19.56^\circ$, $M = 34.62$) $K_- = 39.12$ point 2

K_+ line from point (1) (originating at last step) $K_+ = -19.56$

equation $\theta_2 - V_2(m) = -19.56$

$$\theta_2 + V_2(m) = 39.12$$

$$\text{adding } 2\theta_2 = 19.56$$

$$\theta_2 = 9.78^\circ$$

$$\theta_2 + V_2(m) = 39.12 \therefore V_2(m) = 39.12 - 9.78 = 29.34$$

$$M_2 = 1.94 \quad M_2 = 31.03$$

equation of point 2:

$$\frac{y_2 - 0}{x_2 - 1.406} = \tan \left(\frac{0 + 9.78}{2} + \frac{34.62 + 31.03}{2} \right) \quad \text{--- eqn 1}$$

$$\frac{y_2 - 1}{x_2 - 0} = \tan \left(\frac{19.56 + 9.78}{2} - \frac{34.62 + 31.03}{2} \right) \quad \text{--- eqn 2}$$

$$\frac{y_2}{x_2 - 1.406} = \tan(37.715^\circ) = 0.773 \quad \text{--- eqn 1}$$

$$\frac{y_2 - 1}{x_2} = \tan(-18.155^\circ) = -0.328 \quad \text{--- eqn 2}$$

$$y_2 = 0.773x_2 - 1.087 \quad \text{--- eqn 1}$$

$$y_2 = -0.328x_2 + 1 \quad \text{--- eqn 2 } \quad x-1$$

$$y_2 = 0.773x_2 - 1.087$$

$$-y_2 = 0.328x_2 - 1$$

$$0 = 1.101x_2 - 2.087$$

$$x_2 = 1.9$$

$$y_2 = 0.378$$

③

Point	x	y	θ	J	m	M	$L \frac{dy}{dx}$	$L \frac{dy}{du}$	K_+	K_-
0(1)	0	1	19.56	19.56	1.76	1.76	-	-	0	39.12
0(2)	0	1	9.78	9.78	1.39	4.6	-	-	0	19.56
1	1.406	0	0	19.56	1.76	34.62	-	-0.711	-19.56	19.56
2	1.9	0.378	9.78	29.34	1.94	31.03	0.773	-0.328	-19.56	39.12

$\theta_{w1} = \theta_2 = 9.78$, Calculating Coordinates:

At w_1

$$\frac{y_{w1} - 0.378}{x_{w1} - 1.9} = \tan(9.78 + 31.03) = 0.863 \quad \text{-eqn 1}$$

$$\frac{y_{w1} - 1}{x_{w1} - 0} = \tan\left(\frac{19.56 + 9.78}{2}\right) = 0.262 \quad \text{-eqn 2}$$

$$y_{w1} - 0.378 = 0.863 x_{w1} - 1.624 \quad \text{-eqn 1}$$

$$y_{w1} - 1 = 0.262 x_{w1} \quad \text{-eqn 2}$$

$$y_{w1} = 0.863 x_{w1} - 1.262 \quad \text{-eqn 1}$$

$$y_{w1} = 0.262 x_{w1} + 1 \quad \text{-eqn 2 } \times -1$$

$$y_{w1} = 0.863 x_{w1} - 1.262$$

$$-y_{w1} = -0.262 x_{w1} - 1 \quad \text{add}$$

$$0 = 0.601 x_{w1} - 2.262$$

$$\therefore x_{w1} = 3.76, \quad y_{w1} = 1.986$$

$$\theta_3 = 0, \quad \psi_3 = 39.12, \quad m_3 = 2.5 \quad \mu_3 = 23.58^\circ \quad \text{At point 3}$$

(4)

So, Co-ordinates of point 3:

$$y_3 = 0$$

$$\frac{0 - 0.378}{x_3 - 1.9} = \tan \left(\frac{9.78 + 0}{2} - \frac{31.03 + 23.58}{2} \right)$$

$$\frac{-0.378}{x_3 - 1.9} = -0.412 \quad \therefore -0.378 = -0.412x_3 + 0.7828$$

$$x_3 = 2.817$$

At w_2 point

$$\frac{y_{w_2} - 0}{x_{w_2} - 2.817} = \tan(0 + 23.58) = 0.436 \quad (\text{eqn 1})$$

$$\frac{y_{w_2} - 1.986}{x_{w_2} - 3.76} = \tan \left(\frac{9.78 + 0}{2} \right) = 0.0856 \quad (\text{eqn 2})$$

$$\frac{y_{w_2}}{x_{w_2} - 2.817} = 0.436 \quad (1)$$

$$\frac{y_{w_2} - 1.986}{x_{w_2} - 3.76} = 0.0856 \quad (2)$$

$$y_{w_2} = 0.436x_{w_2} - 1.23 \quad (1)$$

$$y_{w_2} = 0.0856x_{w_2} + 1.66 \quad (2) \times -1$$

$$\begin{array}{r} y_{w_2} = 0.436x_{w_2} - 1.23 \\ - y_{w_2} = -0.0856x_{w_2} - 1.66 \\ \hline 0 = 0.3504x_{w_2} - 2.89 \end{array} \quad \text{add}$$

$$0 = 0.3504x_{w_2} - 2.89$$

$$x_{w_2} = 8.26$$

$$y_{w_2} = 2.367$$

Scale in cm

