Working Model 2D: Tutorial 4

Example 12-6

Bar BC in Figure 1 has an angular velocity of 3.73 rad/s clockwise. Determine the angular velocity of AB and the velocity of the piston at A.
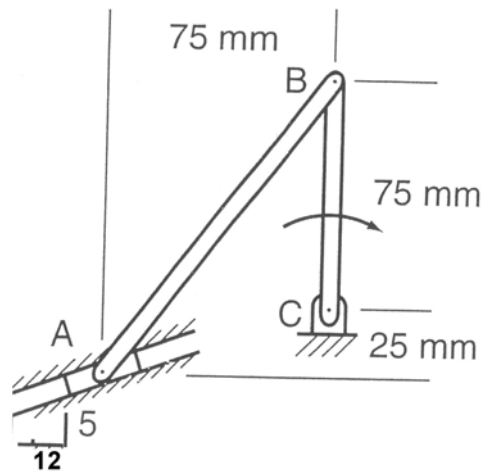

Figure 1

Initial Setup:

1. Set the Unites to SI(radians) on Numbers and Unites… sub menu and click on the More Choices. Set the distance to Millimeters on the Distance pull-down menu.
2. Select the View Size menu from View and set the Window Width to 500 mm.
3. Set the Gravity to None.

Creating Geometry

1. Draw the following entities on the drawing area. You can use the Rectangle drawing entity to draw them. You can quickly edit the position, orientation, and dimensions of the rectangle using the coordinate bar. The X and Y coordinates are the center coordinates of the rectangle.

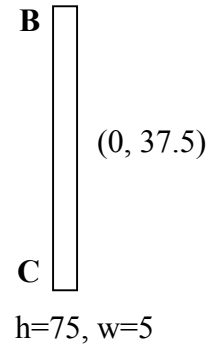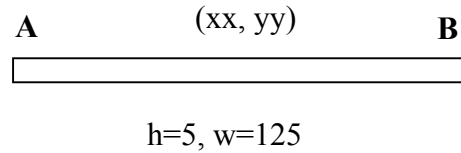A   (xx, yy)   B

h=5, w=125

B

(0, 37.5)

C

h=75, w=5

Figure 2

(Center coordinates for AB can be any value, but position the AB in the vicinity of BC)

2. In order to find the angle of line AB with horizontal direction, use the Figure 1 and calculate the angle as

$$\theta = \tan^{-1}(100/75) = 0.927 \text{ rad.}$$

3. Select link AB and set the angle to 0.927 rad

4. In order to place AB with respect to BC, anchor the later using Anchor ⚓.

5. Place two point elements at the middle of the B ends of AB and BC links.

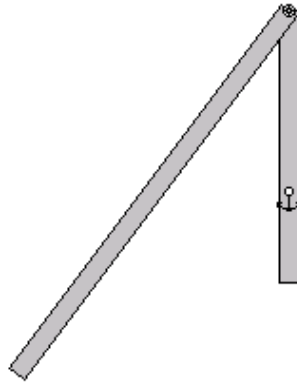6. Join the two points to get a connection similar to Figure 3.

Figure 3

7. Now, anchor link AB too.

8. Select the Slot Joint ![icon] from the tool bar and place it on exactly at point A. You will see a horizontal slot element similar to Figure 4.
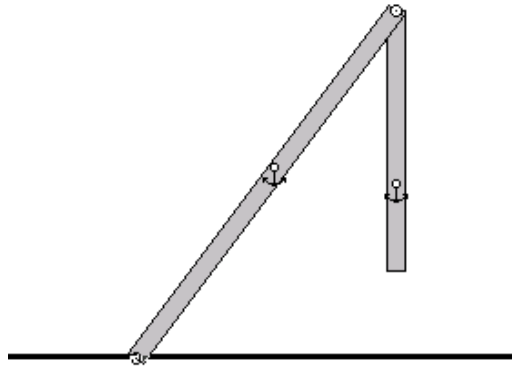

Figure 4

9. Now, select the slot joint and change the angle of the slot joint to 0.395 rad (from $\tan^{-1}(5/12)$). You should have a setup similar to Figure 5.
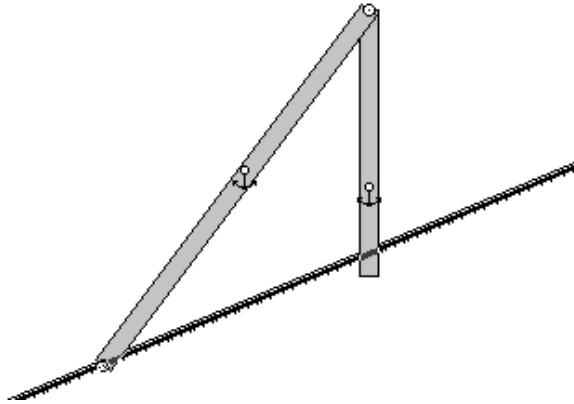
Figure 6

10. Remove all the anchors and place a motor at Point C.
11. Change the motor velocity to −3.73 rad/s.

Post Processing

1. The problem has already been set-up. It is necessary to measure the velocity of the point A and angular velocity of link AB.

2. To measure the velocity at point A, you have to place a new point on top of pin joint and select the Velocity from Measure menu.

3. Select the link AB and go to Measure menu and get the Rotation Graph from Velocity menu.

4. Change the display option to Numerical values in all graphs.

5. Click on Time on the Measure menu to place the time graph. Now, the workspace should look similar to the following Figure 7.
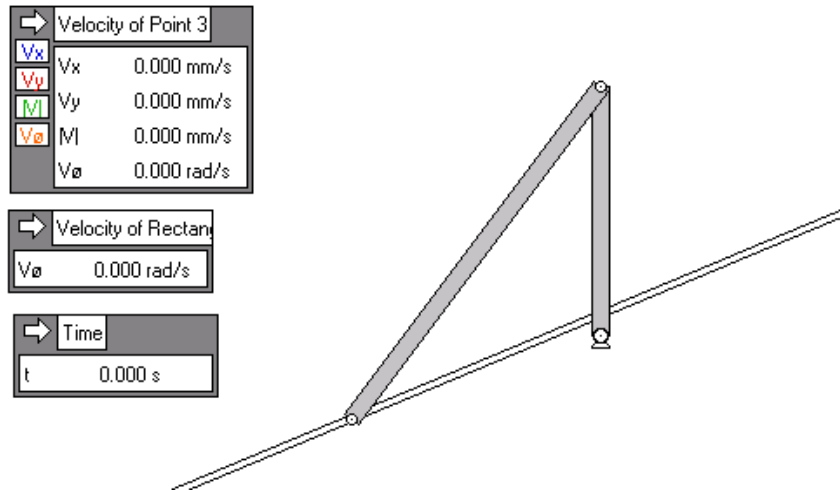
Figure 7

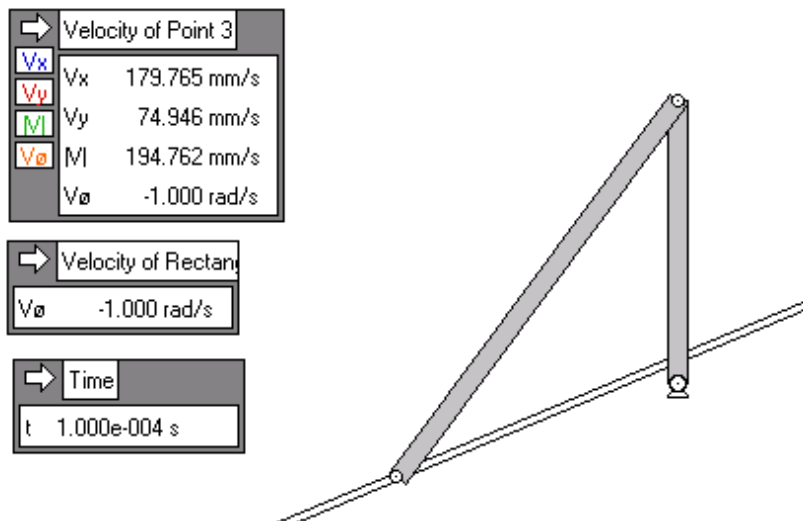6. Click on the Run button to get the results similar to the Figure 8.

Figure 8

Even though we wanted to stop the simulation at t = 0, the time has increased to 0.0001 s. Compare the magnitude of the velocity at point A with the hand-calculated values. Also, compare angular velocity of AB with hand-calculated values.