EBS 289K

Homework 2

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Part 1:

If the row center distance equals to 2 m or 3 m which means the radius of a circle equals to 1 m or 1.5 m, the tractor cannot do that.

The turning radius is a function of L and γ which is $R = \frac{L}{\tan\gamma}$. With the corner case L =2.5 m, the $\gamma_{\max}$ = 45°, the smallest radius we can get is 2.5 m. Thus, no matter we set radius to 1 or 1.5, with the restriction of $\gamma_{\max} = 45^{\circ}$, we can only get a semi-circle with 2.5 radius.

Here are the traces.

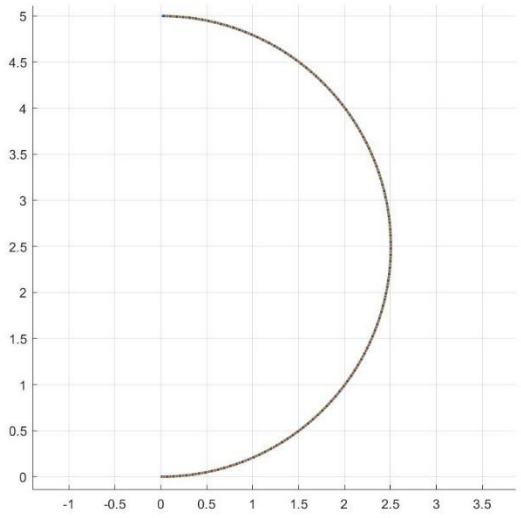

Figure 1: Traces of row-center distance = 2 or 3 m

Part 2:

What if slip is not zero?

The effect of positive slip angles δ1 and δ2 is adding a left turning trend to the tractor. Thus, if applied slip to the tractor, the we can get smaller turning radius. With the increases of the slip δ1=δ2=4, 10, 15, we can get the traces shown below.

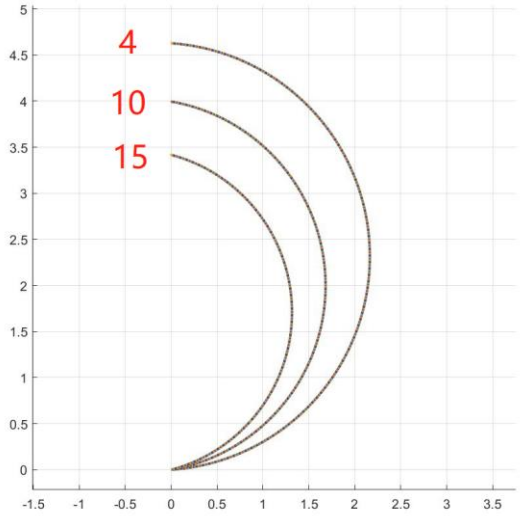

Figure 2: Traces of δ1=δ2=4, 10, 15

What if skidding is zero (δ1= δ2=0) and only slipping affects the rear wheel?

The slip of rear wheel will only effects on the velocity of the tractor but not the turning radius of the tractor since the turning radius is a function of γ and L.

Let's set (δ1= δ2=0) with slip S=0.3. Trace is shown below.

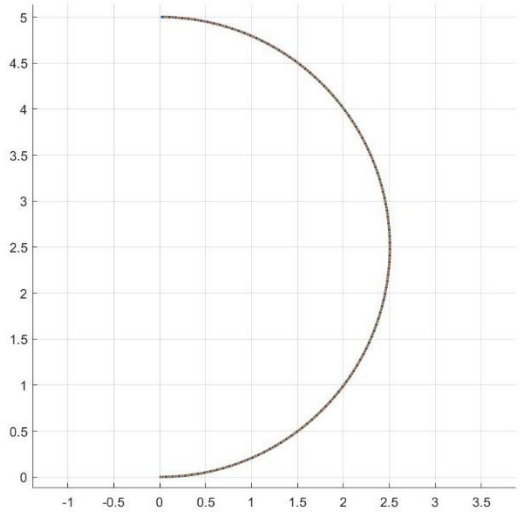

Figure 3: Trace of S=0.3

Part 3:

1. **Steering lag τ_v = 0 s; τ_γ = 0, 0.8,1.6, 2 s**

   The steering lag would have effect on the turning angle. With a τ_γ , the steering angle would increase gradually. Thus, the turning radius would increase. The larger the τ_γ , the larger the radius. Traces are shown as below. The τ_γ we use for each trace is marked in the figure.

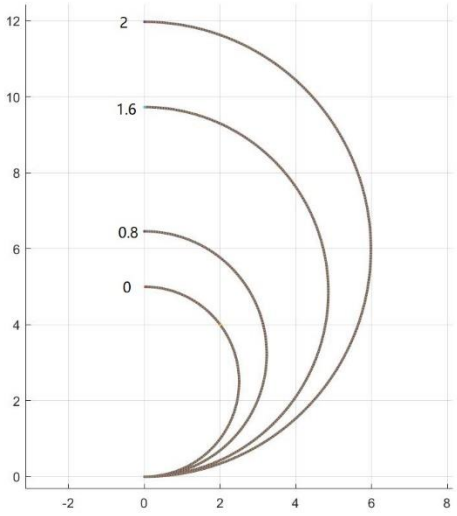

Figure 4: Trace of τ_v = 0 s; τ_γ = 0, 0.8,1.6, 2 s

2. **Speed lag τ_v = 1 s; τ_γ from 0 to 2 s**

   With a tau_velocity, the velocity cannot increase to v_d immediately. The trend of velocity is recorded.

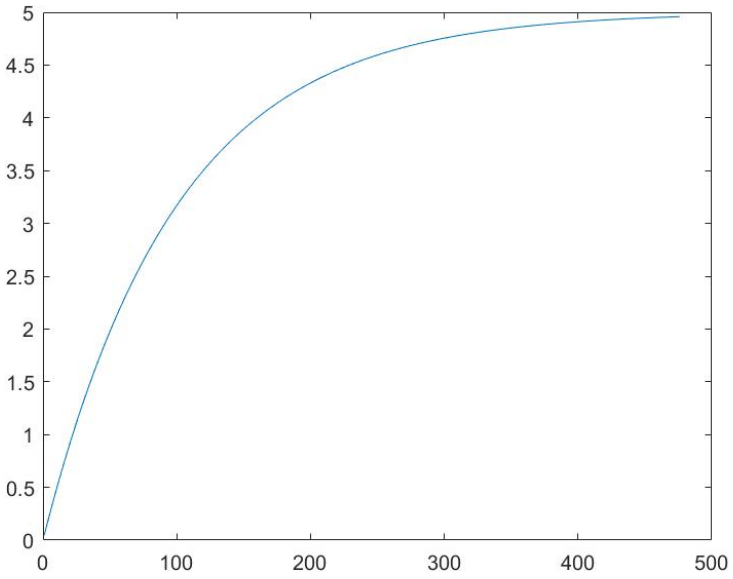

Figure 5: Velocity of Tractor with tau_v = 1

However, the traces are not quite different compared with traces in Figure 4. But differences exist. Let's see traces first and see details.

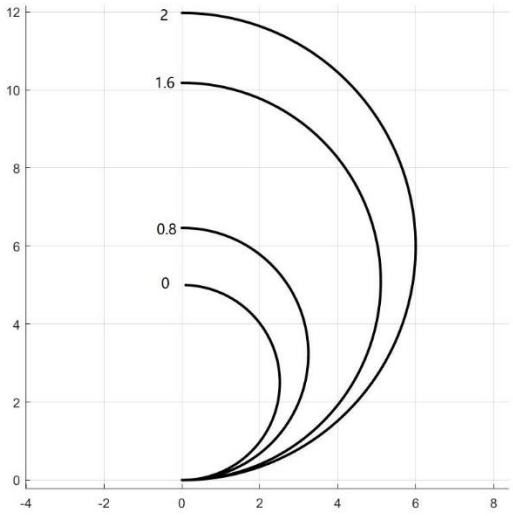

Figure 6: Trace of τ_v = 1 s; τ_γ = 0, 0.8,1.6, 2 s

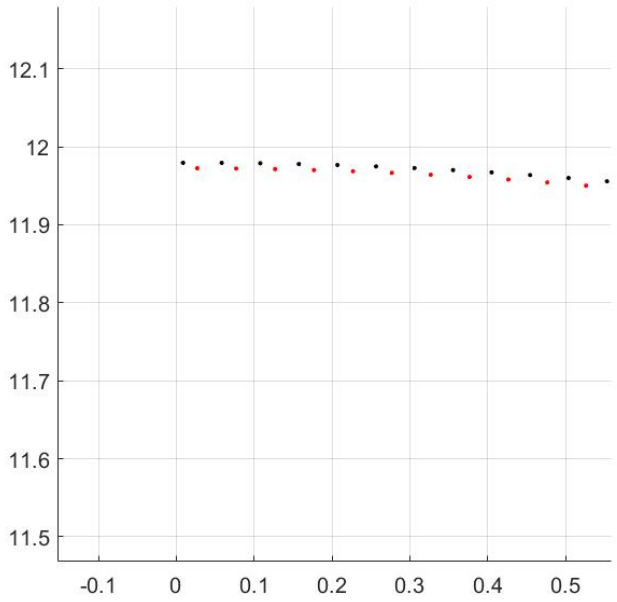

Figure 6: Trace of τ_v =0 s, 1 s

The red dot is the traces without velocity delay; the black dot is the traces with velocity delay.