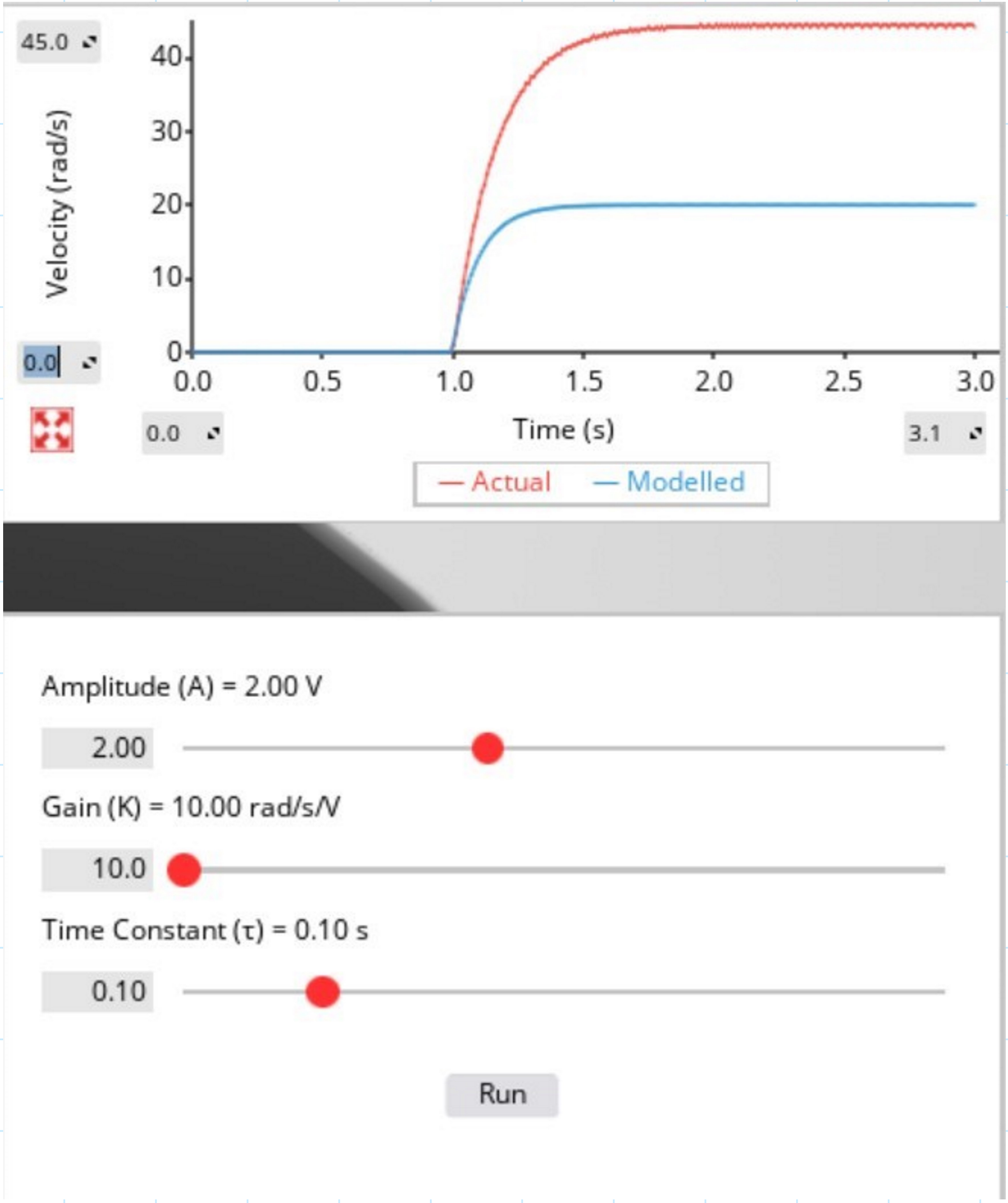
Studio 02

Gino Rospigliosi
UID: 115443037

ENME462
Section 0105

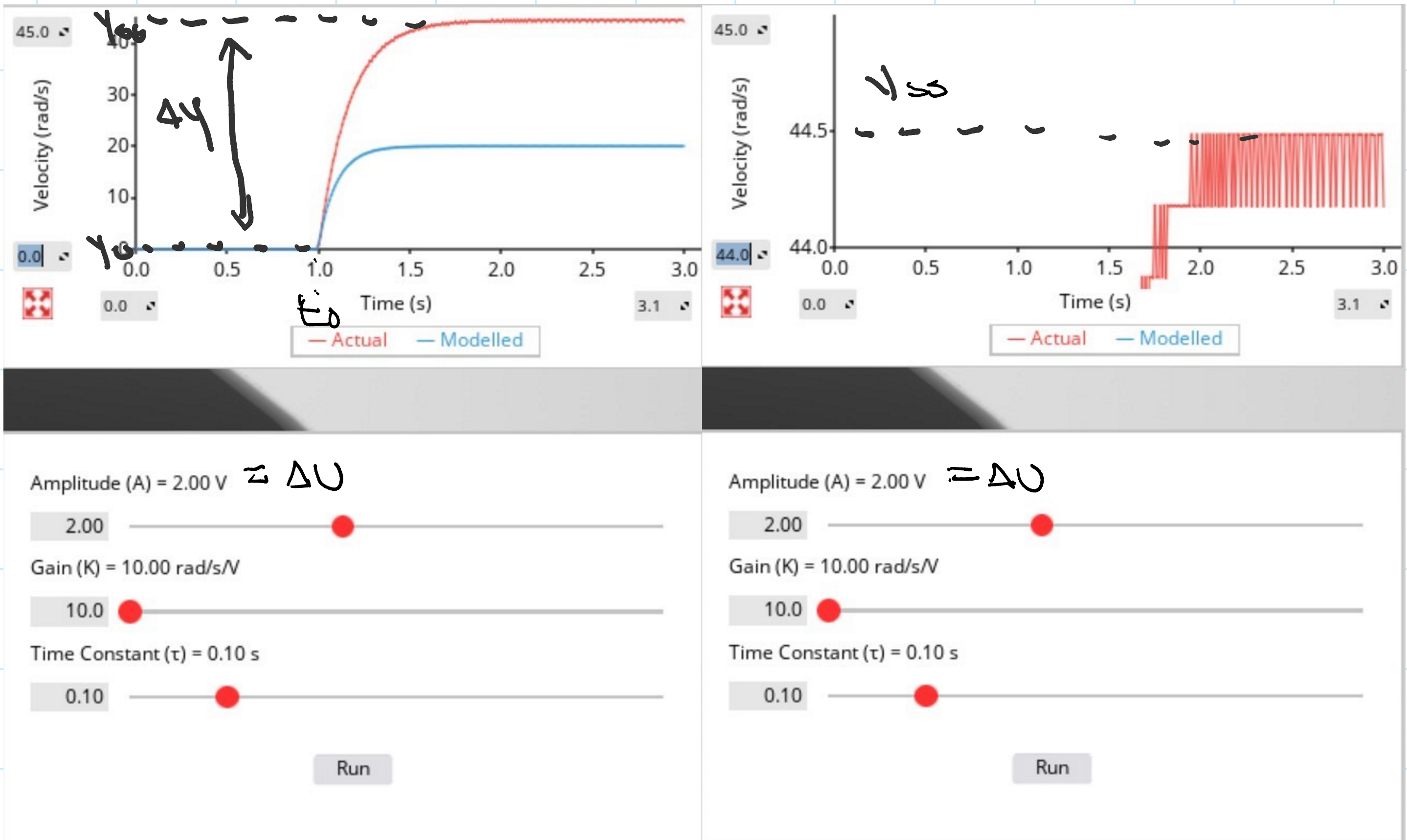
1. Set the **Amplitude** slider below to 2 V.
2. Press the **Start** button to apply a 2 V step input to the virtual QUBE-Servo 2. The step input will be applied instantaneously (at time 0 second) and will last for 4 seconds.



3. Observe the actual response of the virtual system (plotted in red).
   a. Does the response look similar to a first-order system?

Yes, the response looks similar to

a first-order system



4. After the controller stops, use the **response plot** to estimate the system's gain and time constant.
   a. What steady-state gain did you find? Select the answer that is closest to your measurement.
      i. K = 12.5 rad/s/V
      ii. K = 22.5 rad/s/V
      iii. K = 30 rad/s/V
   b. What time constant did you find? Select the answer that is closest to your measurement.
      i. tau = 0.15 s
      ii. tau = 0.35 s
      iii. tau = 0.50 s

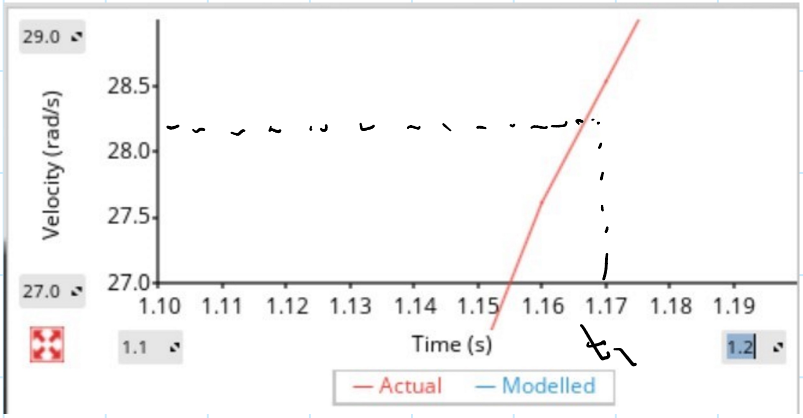
a) Amplitude = 2V

$$K = \frac{\Delta y}{\Delta U} \approx \frac{44.5\,V}{2\,V} = 22.25 \text{ rad/s/V}$$

$$\boxed{\text{ii.} \sim 22.25 \text{ rad/s/V}}$$

b) $y(t_1) = 0.632(\Delta y) + y_0$

$= 0.632(44.5) = 28.124$



$\tau = t_1 - t_0 = 1.17 - 1 = 0.17\ s$

$\boxed{\lambda_1 \sim 0.15\ s}$

$G(s) = \dfrac{K}{\tau s + 1} = \dfrac{22.25}{0.17s + 1}$

a. Does the step input amplitude have any effect on the gain and time constant of the system?

   i. Yes

   ii. No

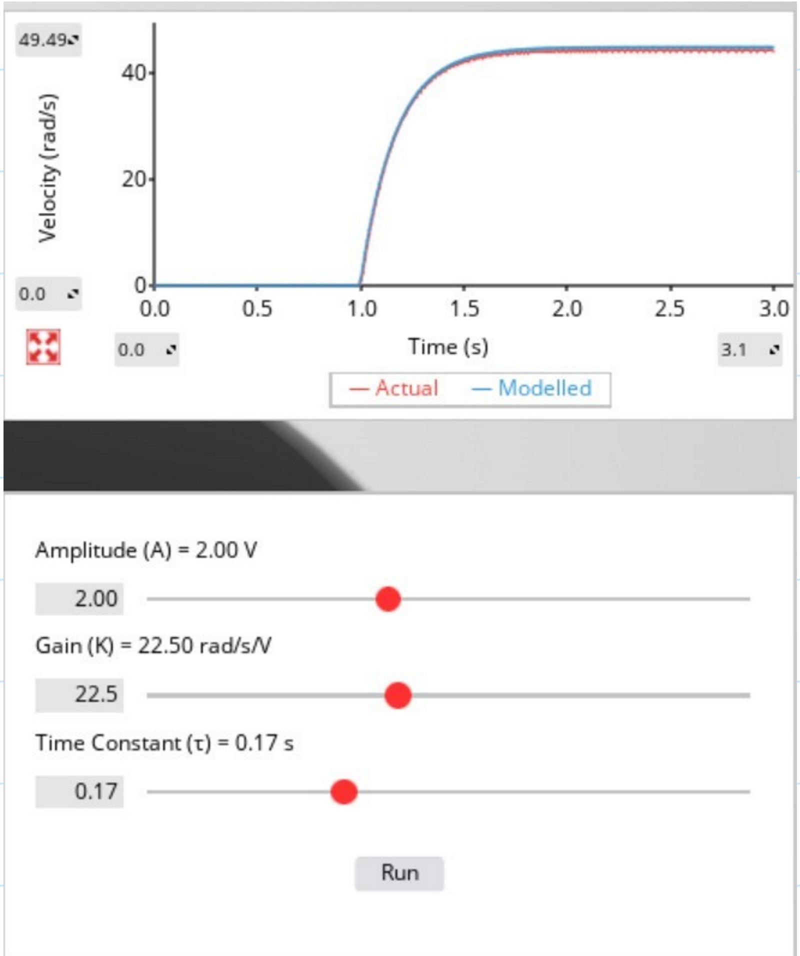
$\boxed{\text{ii. No}}$

6. To validate the model you found, enter the system parameters you determined in the **Gain (K)** and **Time Constant (tau)** sliders. Press on the **Run** button and examine the response of the actual system and the model (with the parameter you found).

   a. Does your model match the actual system?

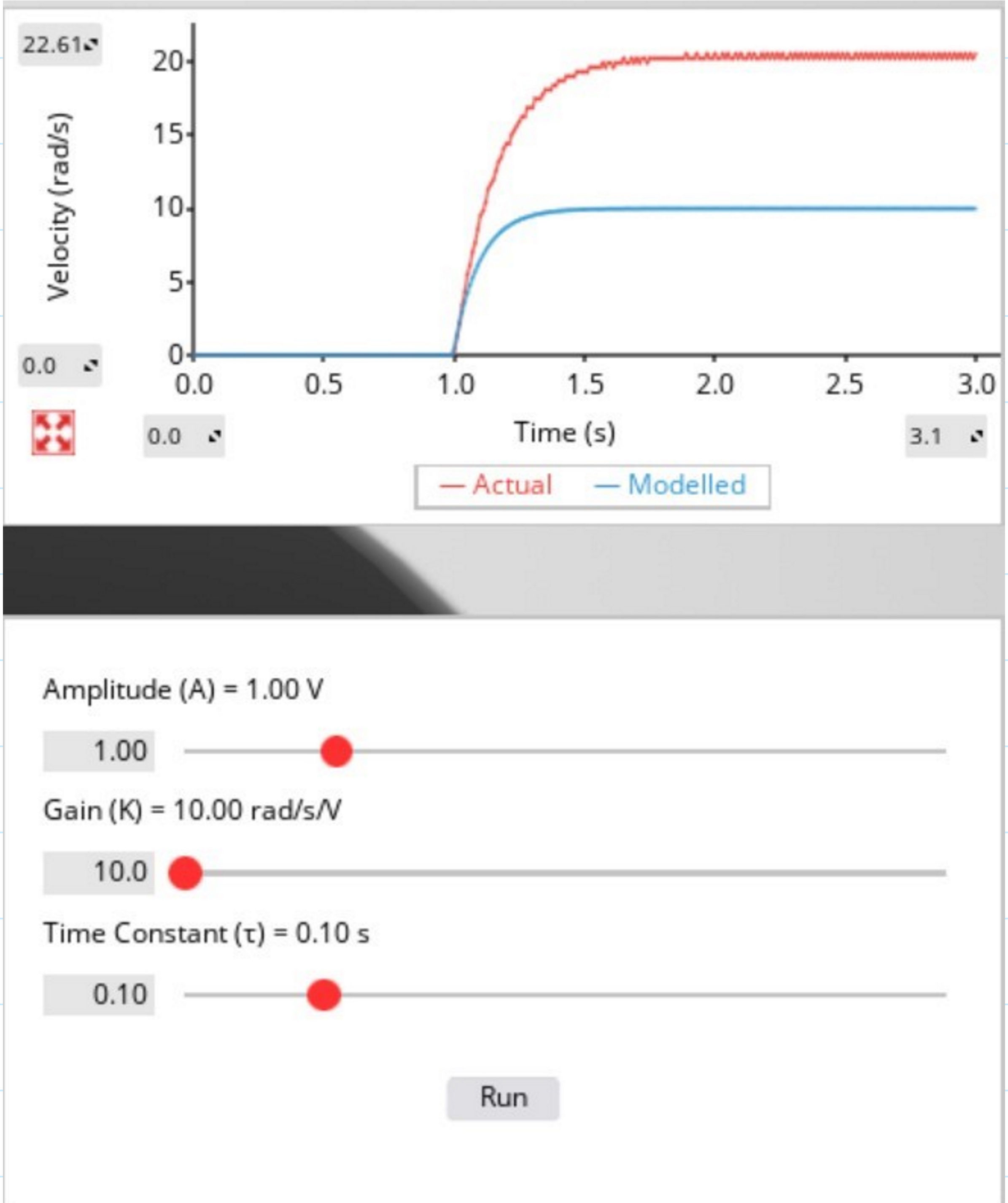
      i. Yes

      ii. No



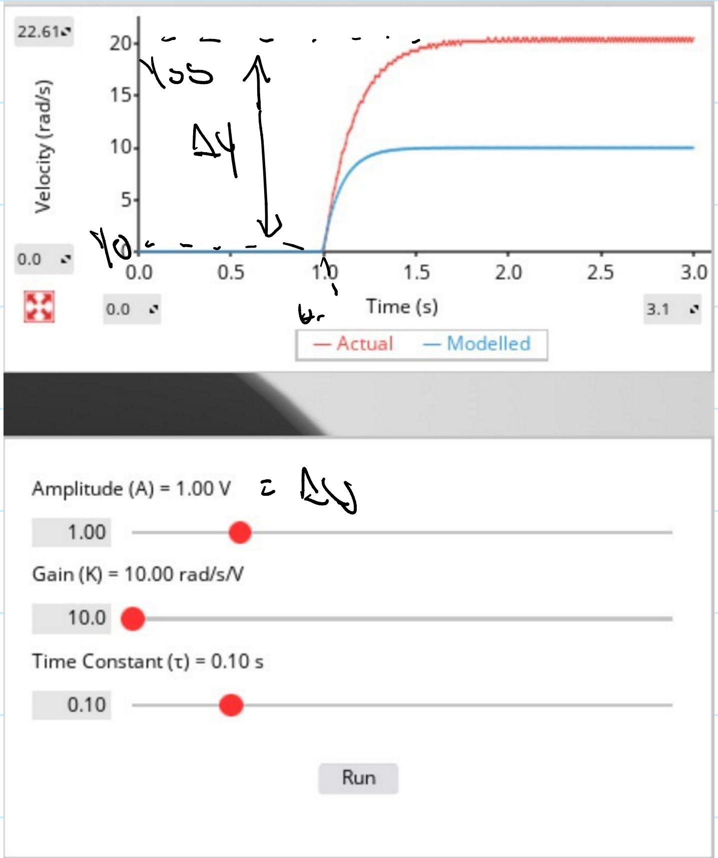
$\boxed{\text{i. Yes}}$

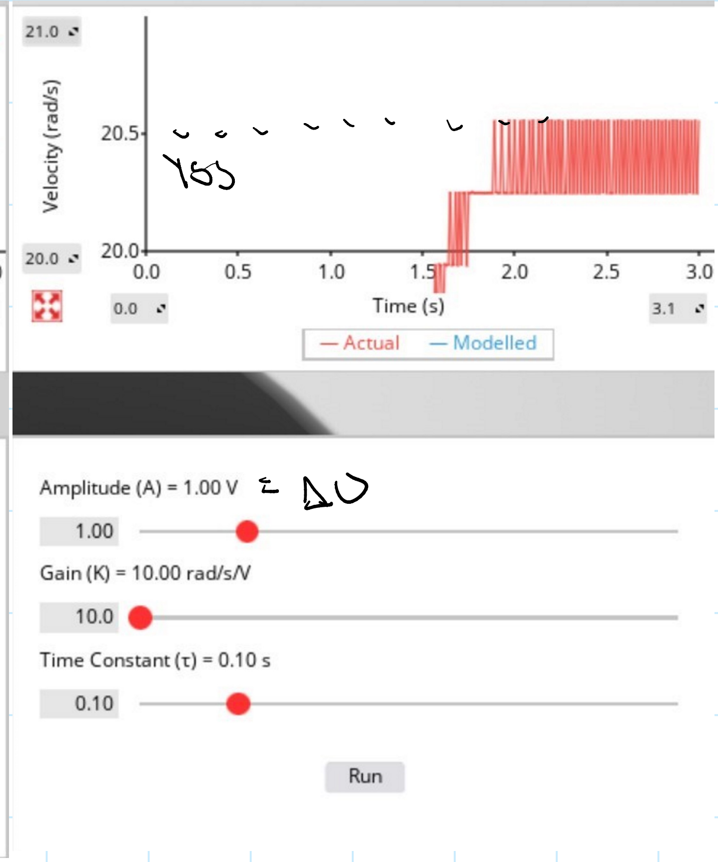
5. Repeat the previous procedure but this time with a different step input amplitude.



3. Observe the actual response of the virtual system (plotted in red).
   a. Does the response look similar to a first-order system?

Yes, the response looks similar to a first-order system





4. After the controller stops, use the **response plot** to estimate the system's gain and time constant.
   a. What steady-state gain did you find? Select the answer that is closest to your measurement.
      i. K = 12.5 rad/s/V
      ii. K = 22.5 rad/s/V
      iii. K = 30 rad/s/V
   b. What time constant did you find? Select the answer that is closest to your measurement.
      i. tau = 0.15 s
      ii. tau = 0.35 s
      iii. tau = 0.50 s

a) Amplitude = 1 V

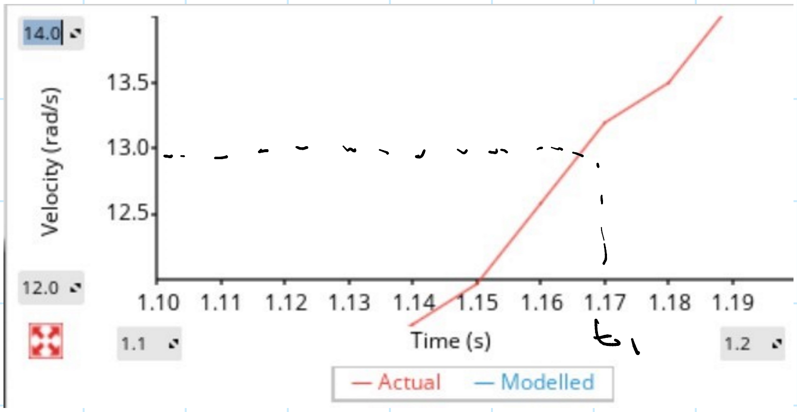
$K = \frac{\Delta Y}{\Delta U} = \frac{20.5}{1} = 20.5$ rad/s/V

$\boxed{\text{ii} \sim 22.5 \text{ rad/s/V}}$

b) $Y(t) = 0.632(\Delta Y) + Y_0$

$= 0.632(20.5) = 12.956$

$$= 0.632(20.5) = 12.956$$



$$\tau = t_1 - t_0 = 1.17 - 1 = 0.17\ s$$

$$\boxed{\lambda_1 \sim 0.15\ s}$$

$$G(s) = \frac{K}{\tau s + 1} = \frac{20.6}{0.17s + 1}$$

a. Does the step input amplitude have any effect on the gain and time constant of the system?

i. Yes

ii. No

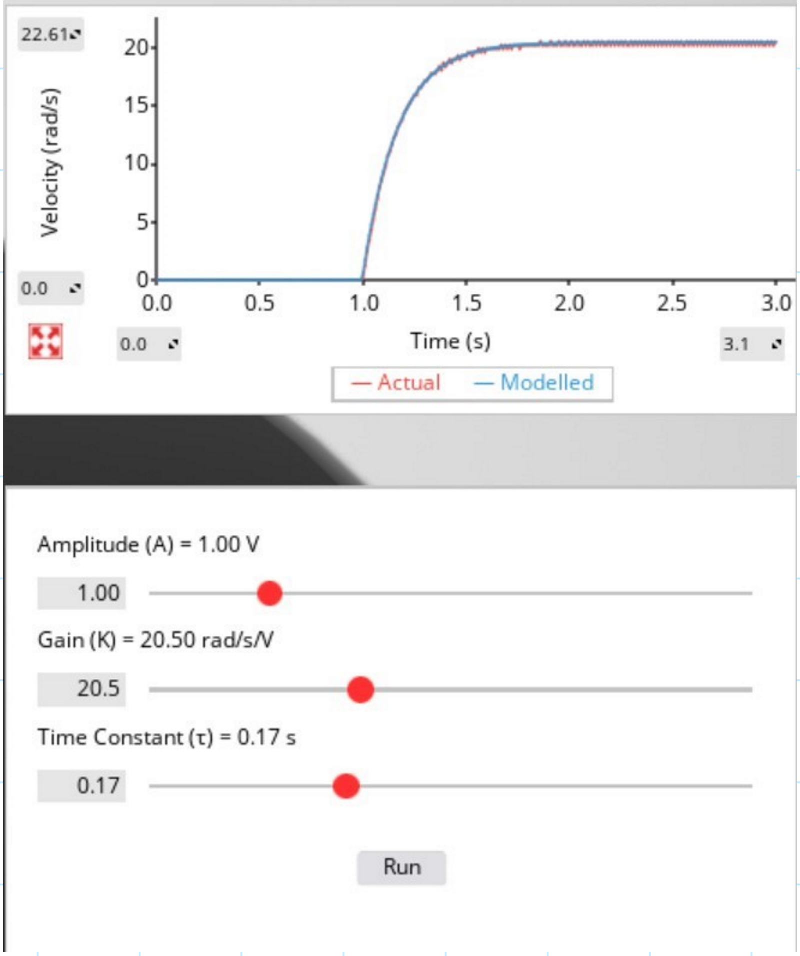
$\boxed{\text{ii. No}}$

6. To validate the model you found, enter the system parameters you determined in the **Gain (K)** and **Time Constant (tau)** sliders. Press on the **Run** button and examine the response of the actual system and the model (with the parameter you found).

a. Does your model match the actual system?

i. Yes

ii. No



$\boxed{\text{i. Yes}}$

3 ASSESSMENT

1) Show how you calculated the system's steady-state gain based on the measured response.
2) Show how you calculated the system's time constant based on the measured response.
3) What is the voltage-to-speed transfer function of the system?
4) Comment on how well the transient and steady-state responses of you modelled system match those of the actual response.

4) Gain slightly differed from

$A = 2V$, $K = 22.25$, $\tau = 0.17s$

$A = 1V$, $K = 20.5$, $\tau = 0.17s$

$\therefore G(s) = \frac{22.5}{0.15s+1}$ is a good model