ME 635 – Modeling and Simulation

Homework 9

Transient and Dynamic Models

11/21/2022

“I pledge my honor that I have abided by the Stevens Honor system”

Submitted by,

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Diagram

Description automatically generated

***Solution:***

The equation can be simplified as;

m + b + kx = b + kz …(Given)

= \* (b + kz - b – kx) …(eq.1)

**Simulink Model:**

Diagram

Description automatically generated

The stop time for the model was set as 20s.

**Model Output:**

**A picture containing text, different

Description automatically generated**

Above figure shows the displacement for the given mass spring damper system for 20s considering the given gain values.

**Note:** [Q1\_Simulink\_file](Q1/Q1.slx)

Text

Description automatically generated

***Solution:***

Diameters: a) 25mm b) 75mm c) 100mm

Initial temperature (Sphere) = 300oC

Initial temperature (Fluid) = 25oC

Density of copper (tau) = 8.96gm/cm3

Film coefficient (h) = 10 W/K.m2

Specific heat = 0.386 J/gm.K

*The mathematical equation formed based on the above given details is as follows.*

m =

*where, d = diameter*

*m = mass*

= \* A ( - )

T = 275 \* + …(Derived from the previous equation)

where, t = time

T = temperature

**Simulink model**

**Diagram, schematic

Description automatically generated**

The figure above shows the Simulink model for all the diameters for this question. Below, individual model for each case is provided and the corresponding plot achieved is also presented.

1. **For dia = 25mm**

**Diagram

Description automatically generated**

**Getting the mass for the copper sphere when the dia = 25mm**

The only varying block in in this section are the “constant block” in the input side which will vary for each case. And the second difference in the “goto” block at the output side to save the mass for each case with different tags.

*m\_1 = -0.0006939*

Diagram, schematic

Description automatically generated

**Simulink model for computing T and plotting.**

Only the “from” block is different for this section of the Simulink model for all the cases. Tag name is same as what was set in the previous mass computation model.

***Output for case 1:***

Chart, histogram

Description automatically generated

**Scope for dia = 25mm**

1. **For dia = 75mm**

Diagram, schematic

Description automatically generated

*M\_2 = -0.0002313*

A picture containing text, clock

Description automatically generated

***Output for case 2:***

Chart, line chart

Description automatically generated

1. **For dia = 100mm**

Diagram

Description automatically generated

*M\_3 = -0.0001735*

A picture containing text, clock

Description automatically generated

***Output for case 3:***

Chart, line chart

Description automatically generated

**Output for all the plots in one scope:**

Diagram

Description automatically generated with low confidence

Increasing the number of inputs in scope for this part.

Plot achieved is shown below:

Chart

Description automatically generated

**Note:**

The stop time for this simulation was set to 18000s (5 days). The reason the stop time was set to such high magnitude is because, on small magnitudes of the stop time, the model gave a linear reducing plot than a curve which was desired since the equation has an exponential term.

Simulink always cropped the magnitudes on the Y-axis. But for reference the highest magnitude received on running the model is 300.

[Q2\_Simulink\_File](Q2/Q2.slx)