MAE 376

Project

Modeling and Analysis of Dynamic Systems

Read "Modeling of Heat Transfer Systems" in sections 7.3.3 and 7.3.4 (pages 350 to 358 of your textbook) to do the following project.
Please cite the page/equation number where you got your equation from.

A watermelon is taken out of the refrigerator at a uniform temperature of 5°C and is exposed to 27°C air. Assume that the watermelon can be approximated as a sphere and the temperature of the watermelon is uniform. The estimated parameters are: density of watermelon ρ = 120 kg/m3, diameter of the watermelon D = 40 cm, specific heat capacity c = 4200 J/(kg·°C), and heat transfer coefficient h = 15 W/(m2·°C).

a. Derive the differential equation relating the watermelon's temperature $T(t)$ and the air temperature.

b. Using the differential equation obtained in Part (a), construct a Simulink block diagram and find the temperature of the watermelon.

c. Based on the simulation results obtained in Parts (b), how long will it take before the watermelon is warmed up to 20°C?

Submit your hand calculations and Simulink files into the corresponding dropbox.

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