

# Assignment 1

(Can be done in teams of 2)

In this assignment, we will simulate a heater using Simulink.

- We will implement an ON/OFF controller for the heater.
- The simulation should start with an initial temperature of 25°C, as shown in the slide below since a real-life heater would not start from zero.
- The differential gap (or deadband) is  $\pm 2^\circ\text{C}$ , meaning the setpoint of 50°C allows a temperature range of [48°C, 52°C].
- The ON/OFF controller has only one parameter: the differential gap, making it a very simple control method.

We should also observe how increasing delay affects both the system's response and its peak-to-peak value.

**Deadline:** End of November

## Assignment 1 Process Simulation



Thermostatic control of temperature is quite common in domestic appliances and in simple industrial processes. A thermostat actuates a relay that switches a heater ON when the temperature is below the setpoint and OFF when it rises above the setpoint.

Simulate an electrically heated water tank (for 30 minutes) if:

At steady state, the water temperature rises by 8°C for every amp of heater current, and the dynamic response of the heater tank can be modelled by a first order lag  $\tau$  of 9 minutes plus a dead time  $\theta$  of 0.5 minute. **The initial temperature is 25°C while the heater is OFF.** The setpoint is 50°C. The heater current is 10 amps when the thermostat is energized. The thermostat has a differential gap of 2°C. Repeat if the dead time is 4.5 minutes.

What is the peak-to-peak variation in temperature in each case?

What are your comments?