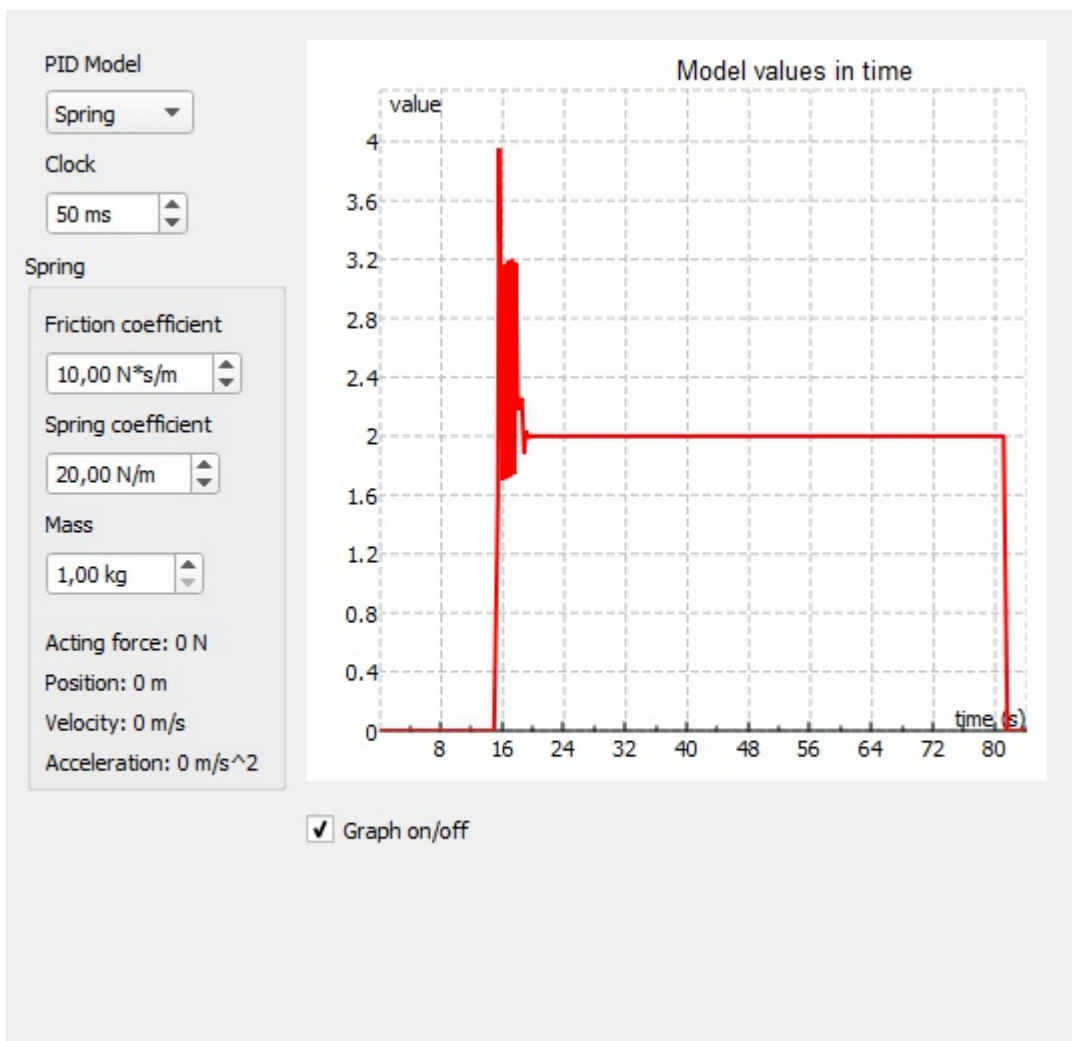


# System model controlled by PID

This document simulates three different systems controlled by PID: second order spring position model, first order heater model and second order DC motor. MatDeck contains PID Model form which allows the user to select the desired model from the drop-down menu. After the model is selected, model parameters are displayed where the user can set the parameters values.

PID Model communicates with the PID controller, using TCP/IP channels which is implemented in a separate document. Both documents should be opened and evaluated at the same time. A graph within the Form displays current values of the controlled variable. The Clock parameter in both document must be set to same value. It determines the period of PID exchange.

```
sa := pid model widget(0 , "model 11")
```



## Model Description

### Heater

Heater model is the first order model which represents a system where air temperature is controlled by an electrical heater. The supply power of the heater is controlled by an external voltage in volts sent by PID through TCP/IP channel.

The air temperature is in °C (degrees Celsius) and same goes for the heater, this is calculated and the

temperature sensor values are determined, these are sent back to PID controller through TCP/IP channel. The current air temperature value is displayed within the graph as well.

The user can set the starting environment temperature, heater gain, and time constant of the heating system. The default values are loaded automatically.

### **Spring Model**

The spring model is actually a simple mass-spring-dumper system. The system is modeled as the second order system. The position of the spring is controlled externally by PID which sends the corresponding value of the force in Newtons (N) through TCP/IP channel.

The position in meters (m), which is determined using a mathematical model, is sent back to PID through TCP/IP channel. The current position is also displayed within the graph.

The user can set the following parameters: friction coefficient, spring coefficient and mass of the item connected to system.

### **DC Motor**

DC Motor is represented by dynamic equations from the DC motor model. The speed of the DC motor measured in rad/s is controlled externally by PID which sends voltage in volts (V) through TCP/IP channel.

The speed of the DC motor is calculated by following a system model, and sent back through TCP/IP channel. The current speed is shown within the graph.

The user can set the parameters of the DC motor: moment of inertia, viscous friction, electromotive force, motor torque, electric resistance and electric inductance. The default values are loaded automatically.