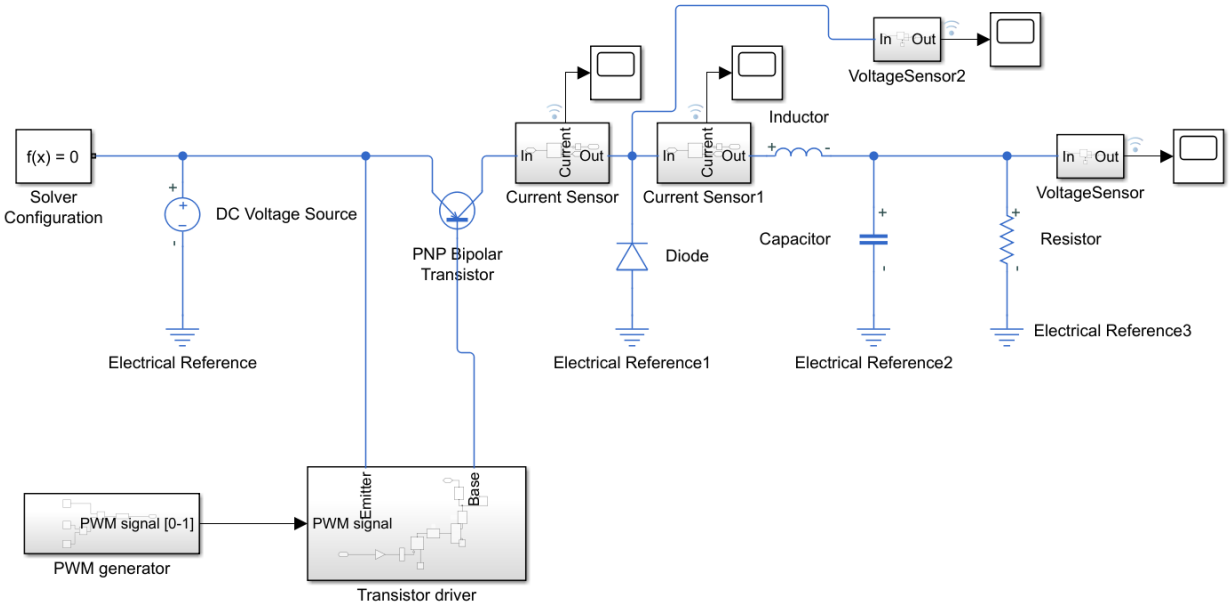
4. Advanced model and simulation

The previously discussed model is a simple representation of the real process. In this chapter we want to get closer to real behavior by using a specialized toolbox, Simscape, inside Simulink.

You must install Simscape and Simscape Electrical toolboxes.

The system topology remains the same, but we must add current and voltage sensors, and a special transistor driver.

Check out Annex 2: Simscape hints.



Task

You will create two scenarios, and you will compare the performance of the systems. In the first scenario, you will configure the components without residual elements, after you will introduce the residual properties, and tolerances. You have to introduce these changes one by one, comparing in every step the results with the a) Ideal simulation, and note down your observations. Make screenshots about the output voltage graph compared to the original.

a. Ideal simulation
   We will configure the model without residual elements, to obtain comparable results with the simple model (calculated values):
   DC voltage source: Uin
   Diode: Forward voltage: 0.1 V; On resistance: 0.001 Ohm
   Inductor: Inductance: L
   Capacitor: Capacitance: C
   Resistor: Resistance: R

b. With residual elements (using L, C values from components with tolerance too)
   i. Diode: Forward voltage: Forward voltage drop (datasheet)
   ii. Capacitor: Series resistance: ESR (you can find in datasheet, or calculate with formula from datasheet, hint Link)
   iii. Inductor: Series resistance: DC resistance (datasheet DCR)
   iv. Capacitor: Tolerance application: Apply minimum tolerance value
   v. Inductor: Tolerance application: Apply minimum tolerance value