

Project 1.

An iron sphere of radius r and unknown temperature T_1 is allowed to cool in air. During its cooling, the current temperature (T) of the sphere is measured at given moments (t) (the time was measured in seconds, while the temperature was measured in degrees of Celsius). The density of iron is $\rho=7800 \text{ kg/m}^3$, while its specific heat is $c=460 \text{ J/kg}^\circ\text{C}$.

The radius of the sphere (r) and the temperature of the surrounding air (T_0) were determined by multiple measurements.

We know that the cooling of the sphere is determined by Newton's law of cooling:

$$T(t)=T_0+(T_1-T_0)e^{-\alpha A c m t},$$

where m is the mass of the iron ball, A is the surface of the iron ball, while α is the heat transfer coefficient between the iron ball and the air.

The measured values can be found in the '*cooling.mat*' data file.

- a) Determine the mass and surface area of the iron ball based on the measured values together with their standard deviations. Examine the data for gross measurement errors!
- b) Determine the temperature of the iron ball at the beginning of cooling and the value of the heat transfer coefficient between the iron ball and the air based on the measured data!
- c) Determine also the measurement uncertainties of the obtained parameters!

Requirements:

1. Describe the process of solving each task in separate document files together with the obtained results!
2. Make m-scripts to solve each task!
3. Pack the document files and m-scripts in the file "*X_Y.zip*" and send it to the address "*bertam@sze.hu*"! (X =last name, Y =first name - without accents) The subject of the letter should be "*Project 1.*"!