

Computer Based Engineering Mathematics (CBEM)

Project 2 – Regression Analysis

The knowledge of the heat flow curve of a material is essential for many calculations in the field of deformation technology. Certain dependencies of the flow tension k_f on deformation parameters, like the deformation φ , the deformation speed $\dot{\varphi}$ and the temperature T , have been known experimentally for a long time.

Expressing these known dependencies in the form of a mathematical function takes the general form

$$k_f = g(\mathbf{x}, T, \varphi, \dot{\varphi}),$$

where T is the temperature of the deformed material, φ is the (amount of) deformation and $\dot{\varphi}$ is the deformation speed.

There are many possible choices for the model function g . One such model function has been introduced in the lecture:

$$(1) \quad k_f = g(\mathbf{x}, T, \varphi, \dot{\varphi}) = x_6 \cdot e^{x_1 \cdot T} \cdot \dot{\varphi}^{x_2 + x_5 \cdot T} \cdot \varphi^{x_3} \cdot e^{x_4 \cdot \varphi}.$$

Another example is the model

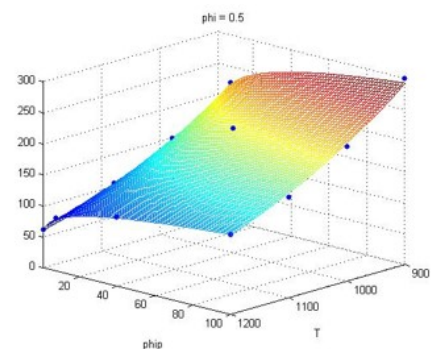
$$(2) \quad k_f = x_5 \cdot e^{x_1 \cdot T} \cdot \dot{\varphi}^{x_2} \cdot \varphi^{x_3} \cdot e^{x_4 \cdot \sqrt{\varphi}}.$$

Task

Using the experimental data provided in the moodle course, find *optimal parameters* \mathbf{x} for the model functions given by (1) and (2). Using these parameters, determine the coefficient of determination R^2 for both of the models, compare the two models and give examples of two-dimensional and three-dimensional graphs by setting the value of one or two of the arguments to their respective minimum, mean and maximum.

Your project solution submission must include a presentation file and all matlab solution files. The presentation should contain

- the parameter values you determined for each of the model functions as well as an explanation of how and why these values were chosen,
- the coefficient of determination R^2 for both models,
- graphs of the predicted values for k_f ,
- a comparison between the two models with respect to their respective prediction quality.



Groups: 2–6 students (you need register for a group via the moodle course by **June 10**).

Deadline: Send your project (.m files and pdf/presentation) to robert.martin@uni-due.de by **July 14**.

Presentation: Each group has to give a presentation (max. 10 minutes) on July 16 (in the last lecture).