Faculty for Engineering Sciences
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UNIVERSITÄT DUISBURG ESSEN

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

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

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:

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

Another example is the model

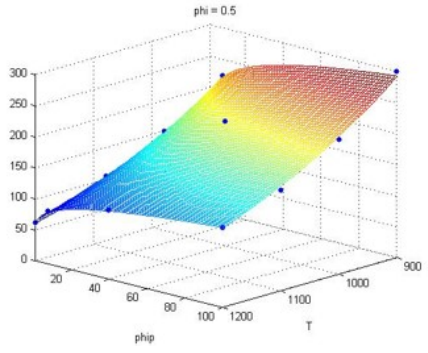
$$k_f = x_{10} \cdot e^{x_1 \cdot T} \cdot \dot{\varphi}^{x_2 + x_5 \cdot T + x_6 \cdot \varphi} \cdot \varphi^{x_3 + x_7 \cdot T + x_8 \cdot \dot{\varphi}} \cdot e^{x_4 \cdot \varphi + x_9 \cdot \dot{\varphi}} \,. \tag{2}$$

Task

Using the experimental data provided in the moodle course, find *optimal parameters* $\boldsymbol{x}$ 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 appropriate constants.

Your project solution must include

- the parameter values you determined for each of the model functions as well as an explanation of how and why these parameters 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: 4–5 students (send your name and matriculation number to robert.martin@uni-due.de)

Deadline: Send your project (.m files and pdf/presentation) to robert.martin@uni-due.de by **10.07.2019**.

Presentation: Each group has to give a presentation (max. 10 minutes) on 11.07.2019 (in the last lecture).