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Mathematical modeling of life-science applications

Mathematische Modellierung von lebenswissenschaftenlichen Anwendungen

Mathematical modeling has become a commonly used tool in the life sciences within the recent decades. There are fundamental differences between modeling in physics and engineering sciences on the one hand and modeling in life sciences like biology and medicine on the other hand. They concern e. g. the inherent qualitative uncertainties about the underlying mechanisms, their hierarchical order, their appropriate mathematical description and the explanation power of the resulting models.

Starting with rather simple applications, we discuss the ability of models to reproduce and predict measurements and observations, sensitivity and robustness properties and the benefit of regarding model families instead of specialized models. We will see that the identification of models can be regarded as a particular parameter identification within a model family, and we will deal with mathematical methods to realize this form of model identification.

We briefly attack the question how the formation of concepts, which itself can be regarded as modeling process, affects our insight in the modeled mechanisms and systems. Finally, we will tend to construct a meta-model of mathematical modeling which allows us to discuss the process of modeling by use of nice mathematics.

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