New approach for parameter identification of multiobjective models

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Abstract

A very important stage of model development is parameter identification through inverse problem solutions. The kinetics of many chemical, biochemical, photochemical, and catalytic reactions is very complex and as a result the kinetic model consists of many equations and parameters. Model parameter identification in these cases is very difficult because of the multiextremal least square function or because of the fact that some minima are of ravine type. The iterative solution of this problem needs very good initial value approximations for the parameters (in the attraction area of the global minimum) for the minimum searching procedure. A polynomial approximation of the experimental data permits to propose a new hierarchical approach for obtaining an initial parameters values in the global minimum area, using a consecutive approximations method. This approach for parameter identification of multiobjective models is tested for two bioprocesses-modeling of fermentation systems and red microalgae growth kinetics. The model parameter values are obtained on the bases of real experimental data. The results obtained show a decrease of the model error variance on every next hierarchical level and a good agreement with the experimental data on the last level.

Keywords: Multiobjective model, model parameter identification, new hierarchical approach, fermentation systems.