

Identification of process model using experimental time series

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The problem of identification of the mathematical model often occurs in the study of systems of different physical nature. Let the estimated model (original system) is an autonomous system of ordinary differential equations with polynomial right-hand sides

$$\dot{x}_i = X_i(x_1, \dots, x_n), \quad (1)$$

where $i = 1, \dots, n$. Then to find such a model, we can use the approach proposed in [1, 2]. If the experiment allows to obtain time series only for one observable variable, for example, $x_1(t)$, we can obtain relations connecting system (1) with a standard system [3]:

$$\dot{y}_1 = y_2, \quad \dot{y}_2 = y_3, \quad \dots, \quad \dot{y}_n = Y(y_1, \dots, y_n), \quad (2)$$

where $y_1(t) \equiv x_1(t)$. After that, we will reconstruct numerically the system (2), and then using the connection between the systems (1) and (2), we can obtain a set of possible original systems (1).

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