APPLICATION OF AN ACTIVE EXPERIMENT TO THE CONSTRUCTION OF STATISTICAL MODELS OF CHEMICAL-TECHNOLOGICAL OBJECTS

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When planning an experiment, each of the factors can take on a certain number of values or levels. If the number of levels is equal to *n*, and the number of factors is equal to *k*, then the full factorial experiment involves *N* experiments, where $N = n^k$. The plan of such an experiment (planning matrix) contains a set of all *N* possible combinations of factors *k*, varied at *n* levels. The most common is a two-level experiment, when *n* = 2. In this case, the factor z_j takes the values $z_j^{\max}$ and $z_j^{\min}$ corresponding to the upper and lower levels.

The value $\Delta z_j = \frac{z_j^{\max} - z_j^{\min}}{2}$ is the variation interval for the *j*-th factor relative to the main or zero level z_j^0, equal to: $z_j^0 = \frac{z_j^{\max} - z_j^{\min}}{2}$. It is obvious that $z_j^{\min} = z_j^0 - z_j$ and $z_j^{\max} = z_j^0 + \Delta z_j$. The chosen values z_j^0 and Δz_j determine the area of the factor space under study, in which the experiment is set up. The value of the interval Δz_j should be large enough so that the effect of varying the factor is not lost against the background of random noise of chemical-technological objects. On the other hand, overestimation of the pull-out interval makes it difficult to adequately describe the object using the regression model.

In *k*-dimensional factor space, the point with coordinates $\left(z_1^0, z_2^0, \ldots, z_k^0\right)$ is called the center of the plan. The processing of the results of a full factorial experiment is greatly simplified if we move from factors z_j written in natural scale to dimensionless variables x_j according to the formula $x_j = \frac{z_j - z_j^0}{\Delta z_j}$.

Then we have:

$$x_j^{\max} = \frac{z_j^0 + \Delta z_j - z_j^0}{\Delta z_j} = 1,\ x_j^{\max} = \frac{z_j^{\min} - z_j^0}{\Delta z_j} = \frac{-\Delta z_j}{\Delta z} = -1,\ x_j^0 = \frac{z_j^0 - z_j^0}{\Delta z} = 0.$$

In this case, the planning matrix takes a standard form, in which all variables at the upper level correspond to the value +1, and at the lower level – the value –1. Sometimes, when filling out the planning matrix, only the signs of the levels are indicated: plus or minus.