Mathematical aspects of determination of the average speed.

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Mathematical methods are important in the study of various aspects connected with the chemical and technological processes in the food industry.

For research of technological problems it is necessary to be able to use mathematical apparatus, know its limits of permissible use.

Mean value theorem mathematically proves the determination of the average speed of a process described by the function $f(t)$ for a certain period of time, particularly in microbiology and chemical and food technologies.

It is known that the classical Lagrange theorem asserts the following fact:
if real function $f(x)$ is continuous on the segment $[a;b]$ and differentiable inside this segment, then there is a point $x = c; a < c < b$ for which the equality fulfils

$$\frac{f(b)-f(a)}{b-a} = f'(c).$$

The wording of this statement may be altered at that. Namely, if we write down the indicated equality as $\frac{f(b)-f(a)}{b-a} = \frac{1}{b-a}\int_a^b f'(t)dt$, the mean value of the derivative turns out to be equal to its value at some middle point.

The statement of this theorem is true, of course, for each segment $[x_1;x_2] \subset [a;b]$, which will have its own middle point. Thus, each finite-difference ratio of functions $f(x)$ is sure to some value of its derivative, and then we can write the following relationship between two sets:

$$\{f'(x)\} \supset \left\{\frac{f(x_2)-f(x_1)}{x_2-x_1}\right\}, x_1, x_2 \in [a;b].$$

Such strict inclusion is satisfied in the general case, but the closures of these sets coincide.

Researches associated with technologies often require computing mean values as a speed $f'(t)$, specified by time t of process passing and a speed $f'(f^{-1}(y))$, characterized by a number y of substance reacted in this process. The monotonic is essential condition for the function $y = f(t)$ here. However, in general, the process is described by a functional dependence that is not monotonic on the given interval.

However, it turns out, if on the time segment $[t_1;t_2]$ the process is determined by the function $f(t)$, which has not infinite levels or the set of its infinite levels is nowhere dense so on the segment $[t_1;t_2]$, there is everywhere dense system of intervals in pairs without common points and $f(t)$ is monotonic on each interval. This fact allows to calculate the mean values of these speeds.

KEY WORDS technological process, food technology, average speed, mathematical method.

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