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«Mathematical modeling of grain mixtures in optimization tasks of the dump bunker’s kinematic parameters»

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The aim and objective of research

The conducted researches were aimed at analyzing the behavior of the quasiridine model for a grain mixture in the technological process of unloading from a dump bunker to a capacity of a technological vehicle.

For further substantiation of the working parameters and design features of the unloading devices combine harvesters.

According to the aim, we must follow tasks that should be solved:

- to analyze the working processes of the combine harvesting devices;
- to research review of the models of quasi-liquids for the grain mix main description;
- to design mathematical models of grain mix in problems of kinematic parameters optimization of a combine dump bunker.
**Методы решения**

Figure 1. The calculation scheme of the problem (within the framework of the quasilicate model for grain material)

Figure 2. Characteristics of the working process parameters of the dump hopper at $\omega_0 = 0.05 \text{ rad/s}$; $\alpha_0 = 3.14/200 \text{ rad}$.

Figure 4. The graph of the lid-tray body side height dependence – $a$ on $\varphi$ is the angle of the natural slope at different values of grain volume weight – $\rho$ and the width of the tray – $b$. 

Figure 5. Schedule of the lid-tray’s height body sides dependence – $a$ on the width of the lid-tray – $b$ taking into account the mechanical and technological properties of the main grain crops.
Выводы

Результаты, внедрение

• 1. In each of the variants of the working parameters of the grain material’s unloading process, the law of bunker’s rotation around the axis is calculated: \( \alpha(t) \), the law of the change in the velocity of this motion is \( \omega(t) \), and also the law of changes in the time of the angular acceleration \( \varepsilon(t) \), \( \text{rad/s}^2 \). For \( \alpha(t) \), in each calculation variant it is established that there is an inflection point, where \( \frac{d^2\alpha}{dt^2} = 0 \). For \( \omega(t) \) in each calculation variant it is established that there is an extremum of the type of maximum, which corresponds to \( \omega_0 = 0.05 \text{ rad/s} \). For \( \varepsilon(t) \), in each of the calculation options, there are two extremes of the maximum type a \( 5.1 \text{ rad/s}^2 \) and a minimum of \( -5.1 \text{ rad/s}^2 \).

• 2. The mathematical model of a grain mixture in the form of a quasiridine using the Navier-Stokes equations is developed. In this case, the optimal structural parameters of the sloping lid-tray are defined: width 2.1 m, length 2.7 m and height of sides 0.4 m for the grain mix (peas, oats, wheat, corn, barley,
Контакты

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