SECTION 3. INDUSTRIAL ENGINEERING

DOI https://doi.org/10.30525/978-9934-26-612-6-6

ON THE ISSUE OF THE DYNAMICS OF AUXILIARY CONVEYOR TRANSPORT

ДО ПИТАННЯ ДИНАМІКИ ДОПОМІЖНОГО КОНВЕЄРНОГО ТРАНСПОРТУ

Chasov D. P.
Candidate of Technical Sciences, Associate Professor, Associate Professor at the Department of Mechanical Engineering Technologies and Engineering, Dniprovsky State Technical University Kamenske, Ukraine

Часов Д. П.
кандидат технічних наук, доцент, доцент кафедри машинобудівних технологій та інженерії, Дніпровський державний технічний університет м. Кам'янське, Дніпропетровська область, Україна

Shpalyarenko S. A.
Postgraduate student at the Department of Industrial Mechanical Engineering, Dniprovsky State Technical University Kamenske, Ukraine

Шпаляренко С. А.
аспірант кафедри галузевого машинобудування, Дніпровський державний технічний університет м. Кам'янське, Дніпропетровська область, Україна

Shpalyarenko O. A.
Postgraduate student at the Department of Industrial Mechanical Engineering, Dniprovsky State Technical University Kamenske, Ukraine

Шпаляренко О. А.
аспірант кафедри галузевого машинобудування, Дніпровський державний технічний університет м. Кам'янське, Дніпропетровська область, Україна

In the presence of stable cargo flows, the adjacent sections of the screw conveyor belt fasteners have the prerequisites (for support racks) assumed to be absolutely rigid. The general principle of studying the dynamics of the screw conveyor motion is to derive the Lagrange equations of the second kind taking into account the kinetic energy of the system, the potential energy of the system, the generalized coordinates and the harmonics of oscillations. The use of the Lagrange equations

of the second kind assumes the presence of retaining connections between the elements of the system, while the connection between the belt and the supporting shaft is one-sided. Therefore, here we have made the assumption of the continuous interaction of the belt and the screw shaft. In the general case, the potential energy of the shaft-belt system consists of the potential energy of the supports and the belt of the working and idle (unloaded) sections. Kinetic energy consists of the kinetic energy of the belt supports, the working and idle parts of the spiral belt, which must take into account the following: the elastic modulus of the belt material, the moment of inertia of the cross-section of the screw as a whole, the deflection function of the belt sections, the force in the working part of the belt, the specific mass of the screw belt material, the mass of the belt support, the cross-sectional area of the belt, the specific mass of the transported material.

For analytical recording of the expressions of kinetic and potential energy, approximating displacement functions can be used, taking into account the displacement of the working and idle sections of the belt.

The potential energy of the belt sections is based on the forces in the working and idle parts of the belt.

The kinetic energy of the supporting elements of the screw belt is formed due to the specific mass of the run material.

The adopted mathematical model of the “shaft-belt” system is the equation of the perturbed motion in the inertial reference frame of the screw shaft, and the belt, its working and idle sections, in the non-inertial frame, that is, the motion of the belt is considered relative to the shaft.

Analysis of the stability of the perturbed motion of the “shaft-belt” system for the generalized stiffness coefficients in the rest state of the belt is determined to be absolutely stable.

Bibliography:

1. Lyashuk O., Serilko L., Hevko I., Serilko D., Lutsiv I., Vovk Y., Levkovich M., Tson O. The investigation of a physical pendulum motion, which move along a horizontal axis. Herald of Karaganda University. *Series "Physics"*. 2022. Vol. 2 (106), pp.75–85.

2. Leonid Vaisberg (). Vibration technology research achievements of the Mekhanobr scientific school and their practical implementation. *Vibroengineering Procedia.* 2019. Vol. 25, pp. 76–82.

3. Yamaguchi, K.; Higashimori, M. 1-Actuator 3-DoF manipulation using a virtual turntable based on differential friction surface. *In Proceedings of the 2018 IEEE International Conference on Robotics and Automation.* Brisbane, QLD, (Australia, 21–25 May), 2018. pp. 3573–3580.

4. Chasov D. Determining the equation of surface of additional blade of a screw conveyor. *Eastern-European Journal of Enterprise Technologies (Engineering technological systems)*. 5/1 (83). 2016. P. 4–9.

5. Chasov D. Devising a procedure for calculating the designed strength of a kingpin-type load-carrying system for an articulated tractor container carrier. *Eastern-European Journal of Enterprise Technologies (Engineering technological systems).* 2020. Vol. 5/7 (107), pp. 22–29.

6. Rogatinskiy R.M., Serilko L.S., Sasuk Z.K., Serilko D.L. (Study of the dynamics of inertial conveyors. All-Ukrainian Scientific and Technical Journal "Vibrations in Engineering and Technologies". Vinnitsa, 2018. Vol. 2 (89). Pp. 41–48.

7. Serilko L. S., Lyashuk O. L., Sasyuk Z. K., Serilko D. L. (The research of inertial conveyor transitional chute oscillations influence on its technical and economic indicators. *Resource-saving technologies of raw-material base development in mineralmini: multi-authored monograph.* Petrosani, Romania Universitas Publishing, 2020. Pp. 293–309.