# Modelling the dynamics of production line control systems in the context of technological safety

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Belt conveyors are one of the main modes of continuous transport in mining enterprises. Current trends in the development of the mining industry require an increase in the capacity of the transport system and its length. The length of modern conveyors exceeded one hundred kilometres and continues to increase. Energy costs for transportation are a significant part of the cost of mining [1].

The most well-known are two ways to control a conveyor system: bunker capacity control and belt speed control. In most cases, it is proposed to create such a mode in which the belt speed changes in proportion to the flow so that the load on the belt remains constant.

Wrong control mode results in a conveyor overload and damage. To increase the stability and of technological safety of the transport system, the transportation route is divided into sections. This allows you to increase the capacity of the transport system and allow the stop of a separate section for repair.

For designing systems for controlling parameters of a conveyor line, two main types of models are used. The first type is distributed, numerical models. Most of the distributed models of a single conveyor are based on the finite element method. The model allows determining the linear density of the material along the transportation route. The second type is the aggregated models. The model is used for estimated calculations of conveyor lines. The model can’t be applied in control systems of conveyor lines under extreme loads and for non-stationary modes.

Conveyor type of production is a kind of the flow production [2]. The model of the conveyor can be obtained in a multi-step description: one-, two-, three-moment description. It should be noted that a conveyor is an ideal object for the use of multi-moment description [3]. An important feature of the modelling of the conveyor is that the material on the belt in different places moves at the same speed. It should be noted that a conveyor is an ideal object for the use of multi-moment description. Partial differential equations take a very simple form and can be solved analytically. In our research, we decided to show the application of the theory on the simplest case. Conveyor models are being explored intensively since the 1970s. Today this is an actual problem, the solution of which is connected to the technological and environmental safety of entire regions.

The report analyzed the multi-section conveyor systems and made a forecast of technological accidents of transport systems. The causes of technological accidents are shown.

## References

1. Pihnastyi O.M. Control of the belt speed at unbalanced loading of the conveyor // O.M.Pihnastyi //Scientific bulletin of National Mining University. – Dnipro: State Higher Educational Institution «National

Mining University». –2019. n.6 P. 122–129. (Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 2019, No 6) https://doi.org/10.29202/nvngu/2019-6/18

2. Pihnastyi O.M. Calculation of the parameters of the composite conveyor line with a constant speed of movement of subjects of labour // O.M.Pihnastyi, V.D.Khodusov // Scientific bulletin of National Mining University. – Dnipro: State Higher Educational Institution «National Mining University». –2018. n.4 (166). P. 138–146. –https://doi.org/10.29202/nvngu/2018-4/18

3. Pihnastyi O.M. Model of a composite magistral conveyor line / O.M. Pihnastyi, V.D.Khodusov // IEEE International Conference on System analysis & Intelligent computing (SAIC 2018). – Kyiv, Ukraine: Kyiv Polytechnic Institute. – 2018. –P.68–72. https://doi.org/10.1109/saic.2018.8516739