A SUMMARY OF THE DOCTORAL DISSERTATION

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"Model of damage development of core conveyor belts with steel cord"

Conveyor belts with steel cord are a significant part of working belts in mines. An important premise for conducting research in this field is the fact that the policies of exchanging conveyor belts in mines are used by individual users only intuitively, based on experience and procedures developed over the years. Uncontrolled growth of damage can lead to dangerous concentration of defects (stresses) in a given section of the belt, which may weaken it and even be the reason for breaking. In the world, magnetic systems for testing conveyor belts were used worldwide already in the 1970s. Until now, the measurement was possible with heads that aggregated data from 40 cm belt width and recorded them as a single channel. Which does not allow the identification of a single damage. At the present stage, thanks to the DiagBelt system, which was created at the Department of Geoengineering, Mining and Geology, one single fault of one cable can be identified, identified on the belt and its length and width measured. In the domestic literature since the 80s, the prediction of the durability of conveyor belts were a matter of studies and in the later years the changes in the core condition of conveyor belts were predicted depending on the working time of the conveyor lengths and length. It has been confirmed that with the passage of time the rate in damage density increases, not only linearly, but in accordance with the power function. And the influence of the conveyor length on the rate of damage accumulation was identified. These were the first quantitative results of such research in Poland. In the world literature, scientists carried out magnetic research already in the 80's, but in their work they focused only on the diagnosis of belt segments. So far, no one has been researching the prediction of damage because of an accurate measurement system. The aim and the doctoral thesis is to analyze the process of changes in the rate of development of core lesions of steel cord tapes and their prediction using regression models and the trend. The subject of the research during the doctoral thesis were damages of conveyor belts with steel wires working in the underground mine.
In this dissertation, five research hypotheses were implemented, then executed and confirmed:

1. Accepted, independent of the length of the sections, measures of belt wear (thickness of damages, area of damage per meter of belt and average area of damage) increase non-linearly in time
2. The distribution of damage density is

a. in the direction X (along the axis of the belt) random,
b. in the direction of Y (across the axis of the belt) uneven

3. Changes in damage density over time are non-linear,
4. Changes in the density of damage surface over time are non-linear,
5. The increase in the average area of damage is non-linear.

The work consists of an introduction, four chapters, ending, a list of used literature, a list of tables, graphs, images and diagrams, and work attachments.

The second chapter contains information on non-invasive diagnostics methods for the core condition of conveyor belts. The specificity of these tests lies in the lack of physical interference in the cover of the conveyor belt. These methods are the exact opposite of destructive tests, such as strength tests, impact tests, fatigue tests, hardness and material structures, and corrosion tests.

The third chapter presents previous attempts to forecast the core condition of conveyor belts, where the authors rely mainly on empirical formulas that were used before diagnostic devices and current durability tests of conveyor belts appeared.

The fourth chapter contains a description of the method of identifying the core damages of conveyor belts in the DiagBelt diagnostic system in one of the underground mines. The test method was also calibrated for damage to the core on the test conveyor and the accuracy of the measurement was described by the device, the results of the change in the density of damages and the state difference along the axis of the strip of the selected section were presented.

The fifth chapter explains results of the present doctoral dissertation as well as regression models and the trend of development of core damages of conveyor belts. The tests covered all sections of belts that worked without major changes in length since they were installed in the loop.

At the end of the work, the final analysis of the topic was made in the context of the research hypotheses taken.

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