Summary of dissertation

Methodology of testing the device for supervising the tension and wear of rubber belts in conveyors

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The main rationale of the paper was to develop the test methodology for a real-time device for tension and wear monitoring of rubber belts in conveyors. The immediate objective of the work was to develop a structural solution for the measuring device, to develop a research methodology, to construct a test stand and to carry out measurements in order to verify both the capabilities of the measuring system and the developed research methodology.

The paper contains a description of the construction and principle of operation of a new device for checking the tension and wear of rubber belts in conveyors, a test stand and additional equipment necessary for the correct calibration of strain gauges used in the device. The paper then describes the developed research methodology and its implementation together with the results of experimental real-time tests of the belt tension in static and dynamic conditions.

The test stand consists of a model belt conveyor with a drive, enabling the adjustment of belt tension and speed of its feed. The measurement system consists of a set of three strain gauges placed on the idler shaft and electronics communicating with a computer via wireless Bluetooth. Data processing is carried out by means of a specially prepared programme, which provides for displaying and recording the obtained data. All mentioned components are the author's ideas and developments. The new device for controlling tension and wear of rubber belts in conveyors has been registered in the Patent Office of the Republic of Poland.

The developed research methodology includes the scope of work covering the initial evaluation of the design solutions, allowing for the assessment of the correctness of operation of two different strain gauge sensors and the selection of one of them. The next research activities were started after confirming the validity of the adopted assumptions and making modifications in the construction of the measuring system. One of the key points of the work was to carry out the calibration in stable laboratory conditions in Radwag company, using specially designed device which was specially designed and manufactured on a 3D printer. According to the developed methodology, static tests were repeated with a stationary conveyor belt and new dynamic tests were performed. Measurements were taken at three different rotational speeds of the roller, with no load and with a mass of 0.5, 1 and 2 kg placed at specific points on the belt. The final item of critical importance in the research programme was the controlled failure of the belt at six locations and the analysis of the collected measurement data.

The developed testing methodology allowed for the final shaping of a prototype device for controlling the tension and wear of rubber belts in conveyors, as well as for demonstrating its measurement capability. After further improvements, the device can be used to monitor the operation of belt conveyors in real time and incorporated into a production system in accordance with the "Industry 4.0" concept.