A LAGRANGE MATHEMATICAL INTERPOLATION ALGORITHM TO FIND OUT THE AUTOMATIC CONTROL OF THE CONVEYOR BELT

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Abstract : The method principle shall be studied which is based on the determination of instantaneous material section by means of 3 ultrasonic sensors, the measurement of band speed by means of the Hall effect transducer measuring drum recycling time. These data are taken and processed by local equipment. After processing by means of a software programs package in C++ Programming Language, the data obtained could be transferred to central equipment displaying the material discharge, the band status and the working time.

1. INTRODUCTION

The present essay does not only embrace a purpose in itself – namely that of speciality, but it also approaches an important and actual issue, that of surface mining in Romania, which is also exhibited on a global energetic market and subject to an acute competition determined by multiple causes: competition with other alternative sources of power, competition with global mining, competition between units operating under different geomining conditions where distinct working methods are being used or even identical.

Excavating tailings (scraping) and extracting useful (lignite) in surface mining pits in the mining basin of Oltenia is done with lines of excavation technology - transportation - dumping high productivity.

Need ability to work linking principal components of technological lines (rotor excavators, high capacity transport, machine dumps) should be economic reasons for electricity consumption.

2. IMPLEMENTING THE SYSTEM FOR MEASURING THE FLOW IN THE TECHNOLOGICAL PROCESS

The method principle shall be studied which is based on the determination of instantaneous material section by means of 3 ultrasonic sensors, the measurement of band speed by means of the Hall effect transducer measuring drum recycling time. These data are taken and processed by local equipment. After processing by means of a software programs package in C++ Programming Language, the data obtained could be transferred to central equipment displaying the material discharge, the band status and the working time. The system also allows the control of programs package achievement.

The solution proposed within this paper, namely the performance of an equipment for the instantaneous measurement of material discharge conveyed on high capacity bands by using ultrasonic sensors allows solving the problem of the already known excavated coal volume within the time unit, essential for the production pursuance for all machinery, for the costs assessment on the product unit and the tracing of each band's profitability on different scheduled sections.

Outer curve through a section of material, fig. 1, is determined using the Lagrange interpolation method. Section instantaneous current material circulating on tape, coupled with integrated speed and bandwidth while determining the volume of coal excavated.
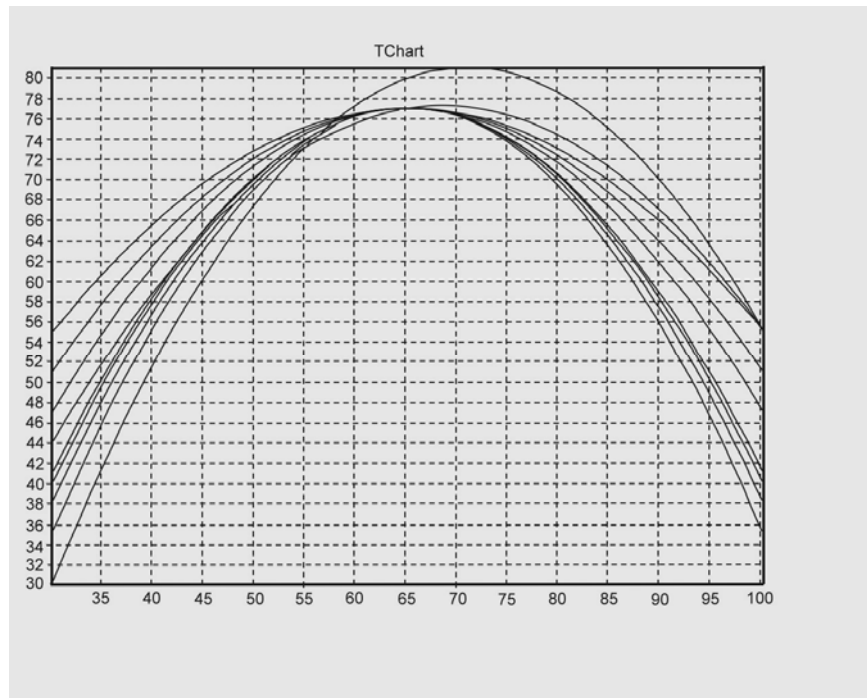
Fig 1. Relatively instantaneous picture of the profile strip - coal layer

Interpolation procedure has four parameters entering and one minus. The first parameter is even mix tape (computer to ON_INIT () stored in the parameter RAM). The next three are just the distances from sensors to tape, these distances are decoded from the packet data communication via computer COM 1 serial interface.

Applying the Lagrange interpolation method, the procedure returns the cross-sectional area in square meters occupied by the coal belt. Where one of the three sensors return a long distance, close to within 2% of distance bottom band - rod sensors, is considered the band at that point is slacking / sterile.

In one case, all three sensors may have very close responses than 2% of distance mentioned above, where the cross-sectional area at that time very powerful time tends to zero, no longer requires a laborious calculation.

The latter is just a particular case, but quite common in practice after the measurements and it is imperative to introduce the general algorithm. It was defined as the Lagrange procedure:

$$Arie \ Ins \tan \tan ee = Lagrange \ (Configuratie \ Banda, \ d \ s_1, \ d \ s_2, \ d \ s_3) \qquad (1)$$

where ds_1, ds_2, ds_3 distances are even returned the sensors. The package is returned to the computer application identified two variables: time to make a full rotation of the drum (dt), and belt condition (sb), which may take two values ($merge/stop$).

Applying the formula $Volum = Arie \ Baza * Inaltime$, it can thus estimate the vehicle volume coal conveyor belt. This volume is calculated amounted to a global variable defined by the program executed by the computer and constant conditions overcome a default configuration file, the computer records on a hard disk data package consists of:

- The time when registration was effected, $Time \ Stamp$
- The volume that was reached by adding, $Volum$
- Band status at that time, $Stare \ Banda$

Possible states of operation for UC (processing unit - display mounted electric room) and LCD (electronic display mounted in the shovelman cabin) are shown in Figure no. 2:
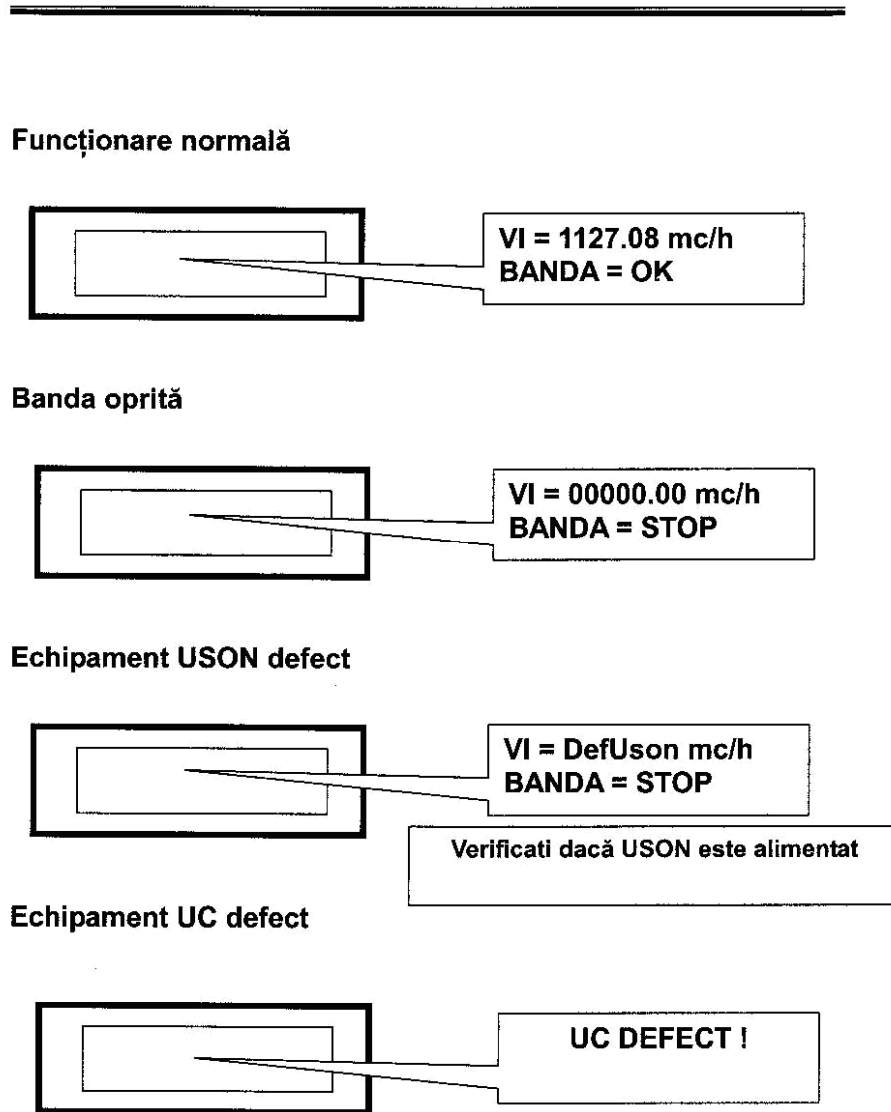
Funcţionare normală

VI = 1127.08 mc/h
BANDA = OK

Banda oprită

VI = 00000.00 mc/h
BANDA = STOP

Echipament USON defect

VI = DefUson mc/h
BANDA = STOP

Verificati dacă USON este alimentat

Echipament UC defect

UC DEFECT !

Fig. 2 Possible operating states for UC and LCD

3. CONCLUSIONS

- The solution implying the use of equipment provided with ultrasonic sensors allows solving the problem of the already known excavated coal volume within the time unit, which is essential for the production pursuance for all machinery, for the costs assessment on the product unit and the tracing of each band's profitability on different scheduled sections. The excavated volume as an instantaneous proportion displayed constantly within the shovelman cabin could allow for the pursuance of band loading, the elimination of non-productive periods of time and the information processing in order to determine the profitability. The freight charges shall be widely reduced as the capacity increases, especially when the transport is done on a long length, due to loading at nominal rating of

actuating motors which supposes a good power factor obtained naturally, achieving consumed power saving.

- As far as the aspect of metallic construction is concerned, the developments to be implemented to the transport system with the specific purpose of improving the technological parameters for material handling are easy to perform and imply relatively reduced costs, being also easily controlled and intelligibly operational for the shovelman and the electrician from the powerhouse within the excavator.

- The solution proposed within the paper in order to determine and control the volume (and implicitly the production) of sterile/coal conveyed on high capacity bands has a high degree of applicability in some other domains. Thus, future directions are foreseen and these are not necessarily related to mining industry. The method could be used successfully for determining the discharge of all materials that are belt conveyed: gravel, chalkstone, cement, etc.

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