

## OPTIMAL CONTROL OF WORKING REGIM AND ENERGY CONSUMPTION IN OPEN PITS EXCAVATING PROCESS

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### **Abstract:**

This paper presents in short a multi-transducer system for optimal correlation between the working regime and the energy consumption of the excavators in open pits; it is intended to have an approximate constant flow of excavated material at the level of reference performances of the outfit at specific optimum energy consumption.

The system carries out the measurements with intelligent transducers and uses technical equipment for acquisition and control. This is integrated into a distributed information system and makes possible the calculation of the required excavator parameters and the energy consumption. By tuning the parameters on, the excavator can be driven optimally, in automatic condition, with reduced energy consumption. The system is used in Romania at EMC Rosia.

**Keywords:** acquisition, energy, transducers, centralized monitoring , real time control

### **Introduction**

The permanent display of the instantaneous amount into the excavatorist cabin allows to trace belt charging, removing unproductive times and managing the information for efficiency determination. Another important requirement is the loop of the equipment and the excavator driving system for a uniform load of the coal on a belt, such as carrying out the automatic control of belt charging.

**The achieving principle of the system** is based on the possibility of the designed equipment to maintain a pre-set value of the excavated flow under the circumstances of excavating parameter variation (cutting, run rotation and conveying), reflected by different energy consumption of the drives between economically optimal and acceptable limits from the point of view of overall safeness of the driven mechanisms.

Through selecting the variation ranges for the monitored energy parameters, there is the possibility to get some information on the behaviour manner of the receptive mechanisms (e.g. the wear of cutting component, wears and additional mechanic resistances to run and rotation) and even on some stresses in the strength metal structure, which at an exceeding of some limits considered as critical, can generate an intervention to avoid technical damage.

By means of the excavated mass determination equipment - based on intelligent transducers in fuzzy logic technology- information on the excavated and conveyed flow is obtained, which represent at the same time the feed-back parameter of system.

By a system of multiple intelligent transducers, information concerning the energy consumptions from cutting, run, rotation and conveying processes, angular speed, relative position, forces and moments will be taken over, all being discharged and processed according to a mathematical model established in this equipment.

An equipment for determining the volume and amount of excavated coal is acting on the excavator run and rotation aiming at the working condition improvement and energy consumption decrease.

**The ECDV equipment is based on the following principles:** coal volume measurement by means of an ultrasonic intelligent (fuzzy logic) transducer assembly, coal amount measurement by an indirect measure of the energy consumed by the motor and a data acquisition, control and processing equipment.

**The system determines:**

- optimal power duty for excavation, depending on the excavated material nature: lignite, marl, clay, etc.
- economic useful life of dipper teeth for rotor excavators;
- optimal power duty for rubber conveyor belts;
- removing of installation deterioration;
- removing of un-productive times/energy losses by limiting the idling;
- monitoring of the excavated coal amount, the consumed power ;
- removing of installation deterioration, detecting the destruction of conveyor belt or runway.

The main economic effect of using this system is that the electric energy consumption decreases during lignite excavation from pits.

**The system contains the following constructive units:** current and voltage unit, belt speed measuring unit, ultrasonic emission- reception unit, coal amount, volume calculation and estimation unit, driving unit for the running and rotation of the excavator, data communication unit.

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