THE CONVERTERS' ROLE IN ADAPTIVE CONTROL SYSTEM TO CONVERSION BY CUTTING THROUGH CIRCULAR SAW

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1. GENERAL CONSIDERATIONS

The way that "MU" gets the values "ap", "f" and "v" separates the control systems of cutting process "RAS" into two categories:

- Control according to MU programme: values "ap", "f" and "v" is determined before the process, except MU, it is registered in MU programme, then is reproduced with possible fidelity, regardless of the variations that occur in the cutting process;
- MU's adaptive control: aims to set the appropriate values of "ap", "f" and "v" or only a part of them, in real-time, permanently, while processing and based on information initially included into the system and some information from the cutting process.

Currently, due to its disadvantages, the control according to MU programme is technically outdated. As a matter of fact all MUs are provided with adaptive control systems ACSs because of their obvious advantages, namely

- Optimization criterion that underlies the adaptive control strategy is the minimum cost of the process, provided that the requirements of quality, dimensional and shape accuracy and surface roughness are fulfilled
- Adaptive control process is based on an algorithm inferred from scientific methods for determining the proposed optimum
- Self-adjustment of one or more parameters of cutting system so that processing maintains the required economic optimum
- Protects the tool and machine tool from overpressure
- Eliminate the disturbance influence

CA benefits are found in (fig. 1), "Experimental layout for testing". After its analysis, automation components are found in SCA(own design) as a result of circular saw FCA-810M equipment used for cutting materials by chip removal.

These are as follows:

- Converter to measure the real power;
- Incremental converter for straight cut;
- Servo valve for feed rate automatic controlling;
- CNA and CAN converters.

2. CONVERTERS ROLE IN ADAPTIVE CONTROL SYSTEM

Converters are devices that convert direct voltage from the output of the active part

transducer "APT" into digital signals and digital signals into direct voltage at the output of comparison element for the servo valve command.

2.1. ANALOGUE NUMERICAL CONVERTER – ANC

Generally, the analogue converter is a device with continuous sequence as an input signal and produces at the output a digital signal whose level coincides with decimal value corresponding to the input sequence and its code.

In our case, real power analogue converter "ANC", being an analogue device, a numerical analogue convertor is interposed between it and the comparison element " EC ". At the TPA output there is a direct voltage which being amplified, gets into "CAN", which transforms the direct voltage into digital signals.

2.2. ANALOGUE NUMERICAL CONVERTER –ANC

Basic components CAN are similar to CAN, with an analog input and a digital, current or voltage output.

It is presented in Figure 2.

Generally, the device has a binary sequence as signal at the input and produces an analogue signal, current or voltage at the output, whose level coincides with decimal value corresponding to the input sequence and its code.

The basic components of an analogue assembler are shown in (fig. 2).

Output voltage of the element of comparison "EC" is incremental. As a result, an analogue assembler is interposed between it and the servo valve "SV", which converts digital signals into direct voltage.

3. ADAPTIVE CONTROL SYSTEM RUNNING

Adaptive control system of the circular saw is shown in FCA-810M (fig. 1). The running principle is as follows:

- With real power transducer - APT – real power is measured at the interface between tool (canvas-disc) and the cutting blank
- At the output there is a direct voltage to be processed (increased or decreased) so as to be compatible with the input values of the other components of automation: "ANC" and "EC"
  - This voltage gets into "ANC" that converts direct voltage into digital signals
  - Real power transducer as an analog device, an analogue assembler is interposed between it and the comparison element "EC" that converts direct voltage into digital signals;
- Previously, the reference voltage is set „P_{ref}” with the aid of algorithm and is included in the comparison element "EC";
  - The comparison element determines the difference „P_{ref} – P_a”while introduction of canvas-disc into the blank to be cut;

- The result of comparison, the voltage "+ / _DU will be processed (increased or decreased) so as to be compatible with the input values of the other components of automation: "CAN" and servo valve control "SV";
  - Voltage "+ / _DU" is incremental, therefore, an analogue assembler is interposed between "EC" and "SV" which converts digital signals into direct voltage;
- voltage "+ / _DU" servo valve control will change the speed rate of the socket, so as not to exceed the maximum pressure applied on the knife of the canvas disc;
- Depending on the sign and the voltage value "DU", the speed rate is automatically changed in such a way to keep equality between the two powers. Thus:
  - If the real power „P_a" is lower than „P_{ref}", servo valve will increase the speed rate;
  - If the real power „P_a" is higher than the „P_{ref}", servo-valve will decrease the speed rate.

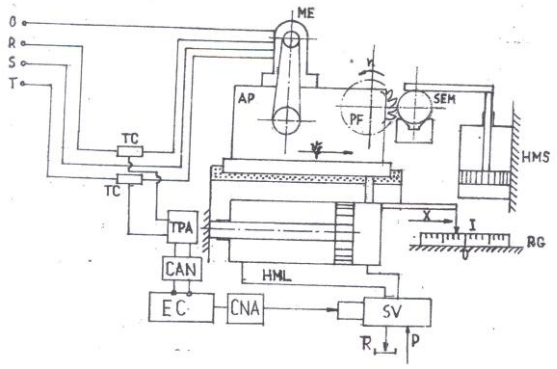

Figure 1 - Layout for experimental testing

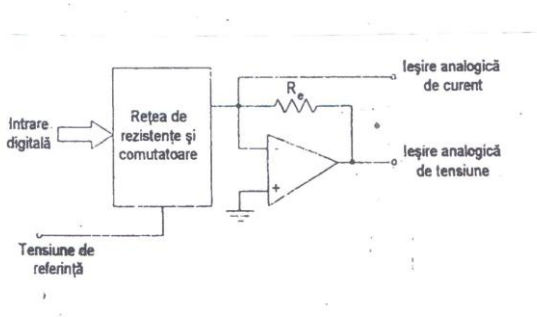

Figure2 – Analogue assembler

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