Modern automatic system for the optimization of the electrical drives for working machines with mechanical branches

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Abstract: - After a consequent adjustable electric drives experience, once with establish of the analysis desiderata's, during of prepares and experimentations time, there are selected some few problems who underlie this work definition. This paper brings some contributions to the optimization of the auxiliary electric drives in the metallurgic industry. This type of drives is presented to the mill stand and to the mechanisms that transmit the motion on the mill cylinders. In the 90's these drives are realized with DC motors [1].

Key-Words: electric drive system, frequency converter, System for adjustment speed to asynchronous motor, flux bearing, speed adjustment of a high power asynchronous motor.

1. Introduction

It is very acquaintance the fact as processing to cold or to warm industry it is well know by the complex process, with often starting and functional reversing. These thinks impose the using of the DC and AC motors. [2]
Until the last decade asynchronous motors are not used because of their mechanical characteristics that are considered excessively rigid.
Until the apparition of the frequency converters (with adjustment characteristics similar with the complete order redressers) the adjusting control of the three-phase asynchronous motors are made with field orientation (an perfect analogy between the DC motors and the 2 phased-2 axes model of the asynchronous motors).
Furthermore, the great development obtained in the last time on the command technique, the electronics blocks, the microprocessors and personals computers domains are conducted to the great performances of AC motors adjustment characteristics, even better than DC motors characteristics.
The most important advantages of AC electric drives are the bouncing construction ("no-dead" construction) and no maintenance measurements for the single phase and three phase asynchronous machines.
This paper treats some possibility of main electric drives optimization by using asynchronous motors.[1]
The static frequency converters can assure the regulation of asynchronous motors speed thru the continuous adjustment of the frequency f, with the maintaining constantly of U_1 / f_1 rapport. [3]
In fig.1 is presented the basic diagram with the principal's component elements.

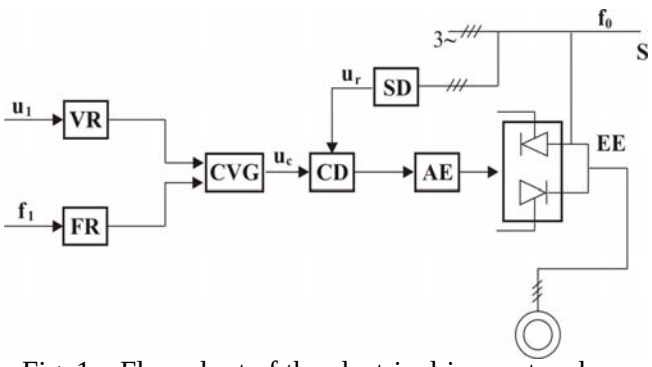

Fig. 1 – Flow chart of the electric drive system by frequency converter for asynchronous motor

Component elements of the frequency converter are:

S – three phase voltage source;
EE – thyristors group represented executive element;
SD – synchronized device;
CVG – cue voltage generator;
VR – voltage regulator;
FR – frequency regulator;
U_1, f_1 – barred measurements

For current and speed adjustments of an asynchronous motors with three phase-wound rotor it can be used an impulse command schema. On the low function time drives, for economical reasons, the supplementary losses by causes of different adjustment speed methods can be admitted.
Installation utilization permits the variation of rotor resistance with static commutation for the three phase asynchronous motors with coil rotor. This process is based on the thyristors constrained commutation and the converter used for the inductor are calling impulse converter.
In fig.2 is represented electrical circuit by force utilized for speed adjustment and for optimization action of a mechanism with bigger kinetic inertia.[6]

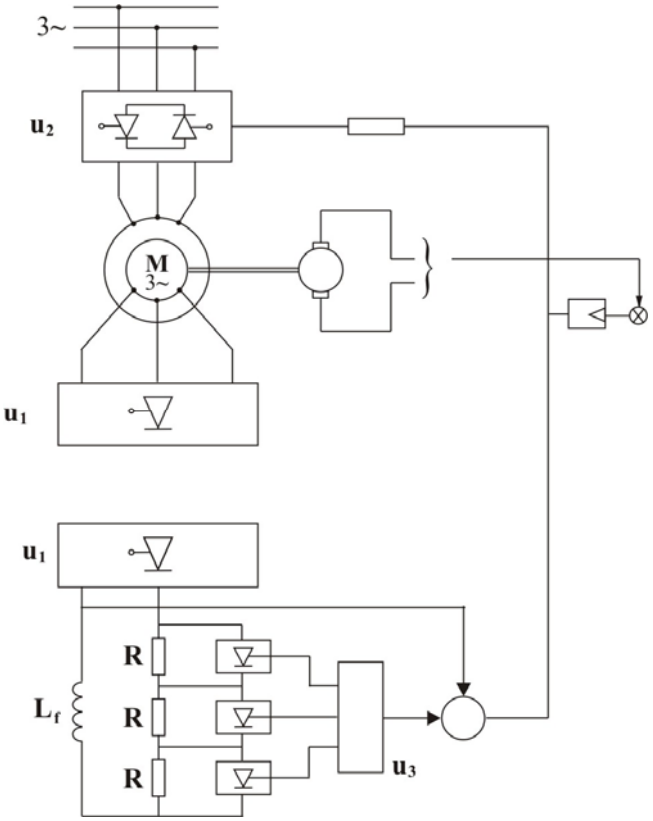

Fig.2 – Block diagram of the electric drive system for an asynchronous power motor with coil rotor

2 Drive system with adjustable speed motor using the method of rotor flux bearing

In the last years, the necessity of AC motors replacement for the high power drives grows up. For this reason, the asynchronous motors with the same power and with a big scale of adjustment are used, in majority of cases the adjustment are made using the method of rotor flux bearing.
In fig 3 are presented an adjustment speed system for an asynchronous motor using the method of rotor flux bearing. [7]

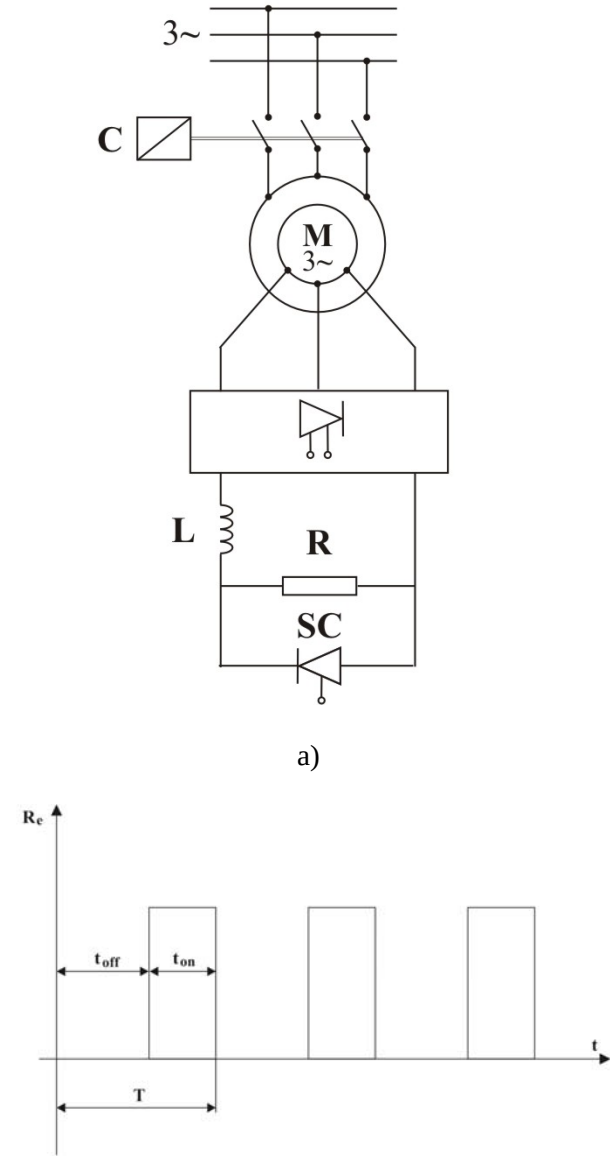

Fig.3 – System for adjustment speed to asynchronous motor using the method of rotor flux bearing
a) Electrical diagram b) Time variation from resist

Rotor voltage (variable with armature slip) is rectified and then resistance R in connected. The value of R can be modified with a complete commanded rectifier CS, banked together with the resistance. [4]

Variation current speed di/dt is damped thru L inductance. If CS is blocking on the t_{off} and it run on the $t_{on} = T - t_{off}$, then the variation of the equivalent resistance R_e of the R group is presented in fig. 3-b.
Average value of the circuit resistance on the function time for AC machine is $R_e = (1 - t_c) / R$.
The continuous modify of the t_c / T factor between 0 and 1 conduct to a continuous adjustment of resistance between 0 and R.
In the fig. 4 is presented another method of adjustment speed thru a resistance banked together for each phases of rotor circuit and a group of two thyristors mounted antiparallel.
In the low power applications we can use another type of semiconductors device like IGBT or IGCC transistors.
By variation of the time or by variation of the frequency from the command impulses we can adjust the variation of the resistance and implicit the motor speed.[5]

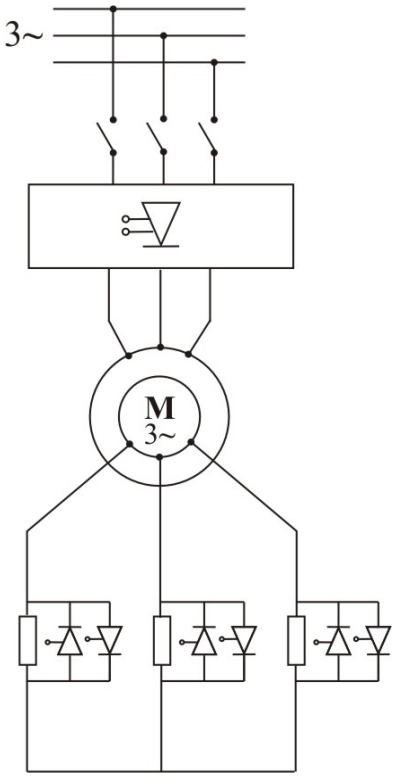

Fig.4 – Speed adjustment of the asynchronous motor using individual static contacts

The equipment using for the start of the three phase asynchronous motors with coil rotor is destined, by his connection on the rotor circuit, to follow and to adjust the dynamic variations of the characteristic value for the start of the asynchronous motor with coil rotor.

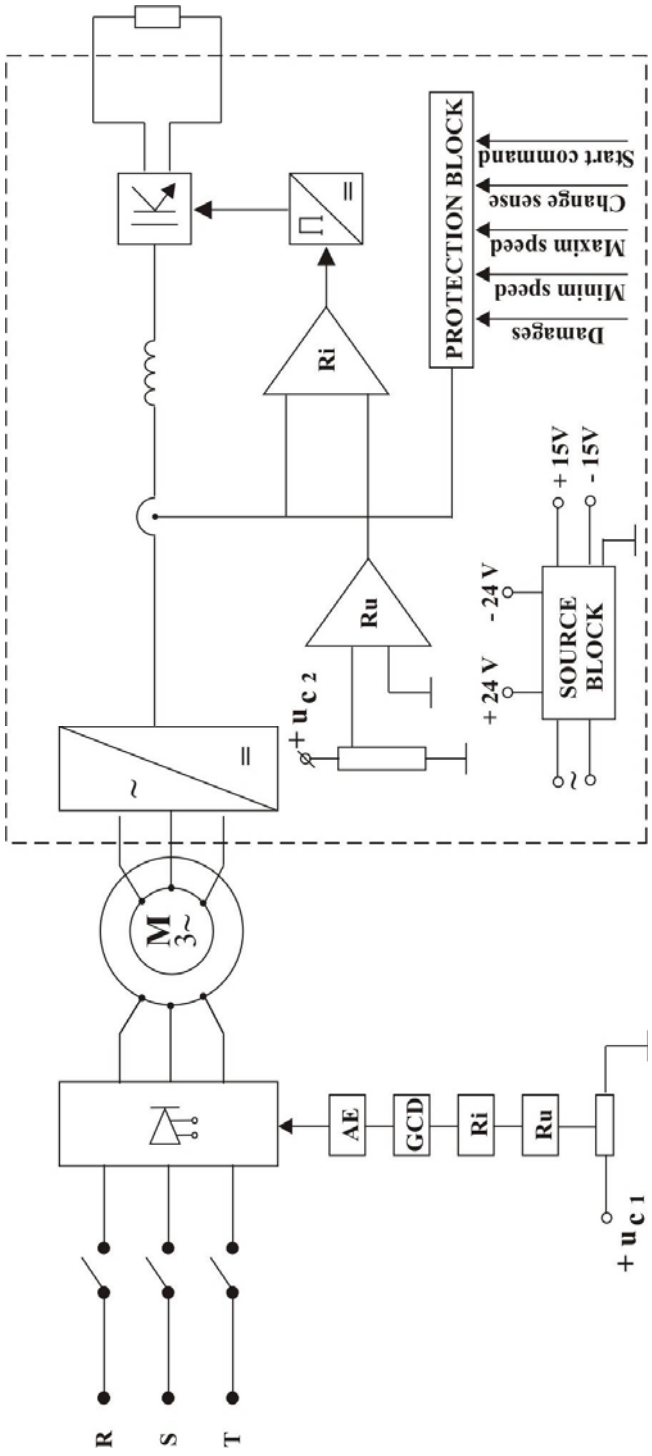

Fig. 5 – Block diagram of the speed adjustment for the asynchronous motor using the method of rotor flux bearing

3 Conclusions

The accentuated aspects from these paper chases relieving of new methods for the speed adjustment of a high power asynchronous motor used for the mechanism with bigger kinetic inertia and robust working machines and solve some problems like:
– Study of the technical process from the speed adjustment of the asynchronous motors with coil rotor bigger than 400 kW;
– Establishing optimum technical solutions for the electric drives. This trend contributes to the replacement of the AC drives and rotate converter;
– Current adjusts and speed adjusts for the three phase asynchronous motors with resistance commands on impulse;
– Speed adjustment for the asynchronous motor using the method of rotor flux bearing;
– Elaboration of the Block diagram for the asynchronous motor with the electrical model.

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