A&QT-R (THETA 13)
International Conference on Automation, Quality and Testing, Robotics
May 23 – 25, 2002, Cluj-Napoca, Romania

AUTOMATIC, GENERAL ELECTROMAGNETIC SYSTEM FOR PRODUCING REACTIVE POWER IN STATIC STATE, FIXED AND THE MINIMIZATION OF THE CONSUMPTION OF THE ACTIVE ENERGY IN TURNING STATE

Zărnescu Horaţiu

prof. dr. eng. at "Petru Maior" University from Tg. Mureş
str. Nicolae Iorga Nr.1 Tg. Mureş
e-mail: zarnescu@upm.ro

ABSTRACT

This paper presents the summary of the RO-BOPI 3/2000 invention [1], which describes a method, an automatic system and electric machines fixed and turning for electric power consume optimization.

The invention refers to a method, an electromagnetic general system with fixed or turning state, complete automated and electric machines subordinated to the system, respectively static synchronous static compensators or electrical motors with superior energetic characteristics analogous with synchronous machines.

THE STRUCTURE AND SYSTEM PRINCIPLE

Figure 1 presents the structure of the electromagnetic general system where is pointed two symmetric rotor and stator magnetic circuit.
The method presented in this paper is based on closing in to a circuit with feedback the system's structural units, which is associated with the general equation of energetic transformations of electromagnetic fields, which allows to control the density vector of Poynting energies $\overline{S} = \overline{E} \times \overline{H}$ and optimal adjustment of radiated power $\oint \overline{S}\, d\overline{A}$ passed through frontier of closed surface (A). This optimal process is obtained through control and application of electric impart field $\left(\overline{E}_i\right)$, by supplying two compensation wrap rotor (d_c,q_c), shifted with 90 electrical degree and a three-phase wrap rotor (a_{r1}, b_{r1}, c_{r1}), which produces on frontier surface (A) Poynting vectors analogous to those obtained in synchronous machines.

THE PRINCIPLE AND OPTIMAL METHOD OF ENERGETIC PROCESS

In case of the previously presented system, it is possible to apply the general equation of energetic transformations in the electromagnetic field, where we can distinguish structural units given by expression:

$$-\frac{\partial}{\partial t}\int_V\left(\frac{1}{2}\varepsilon\overline{E}^2+\frac{1}{2}\mu\overline{H}^2\right)dV=\int_V\frac{\overline{J}^2}{\gamma}dV-\int_V\overline{J}\,\overline{E}\,dV+\oint_A\overline{S}\,d\overline{A}$$

where $\overline{S}=\overline{E}\times\overline{H}$ represents the Poynting vector of energy radiation passed through frontier surface (A).

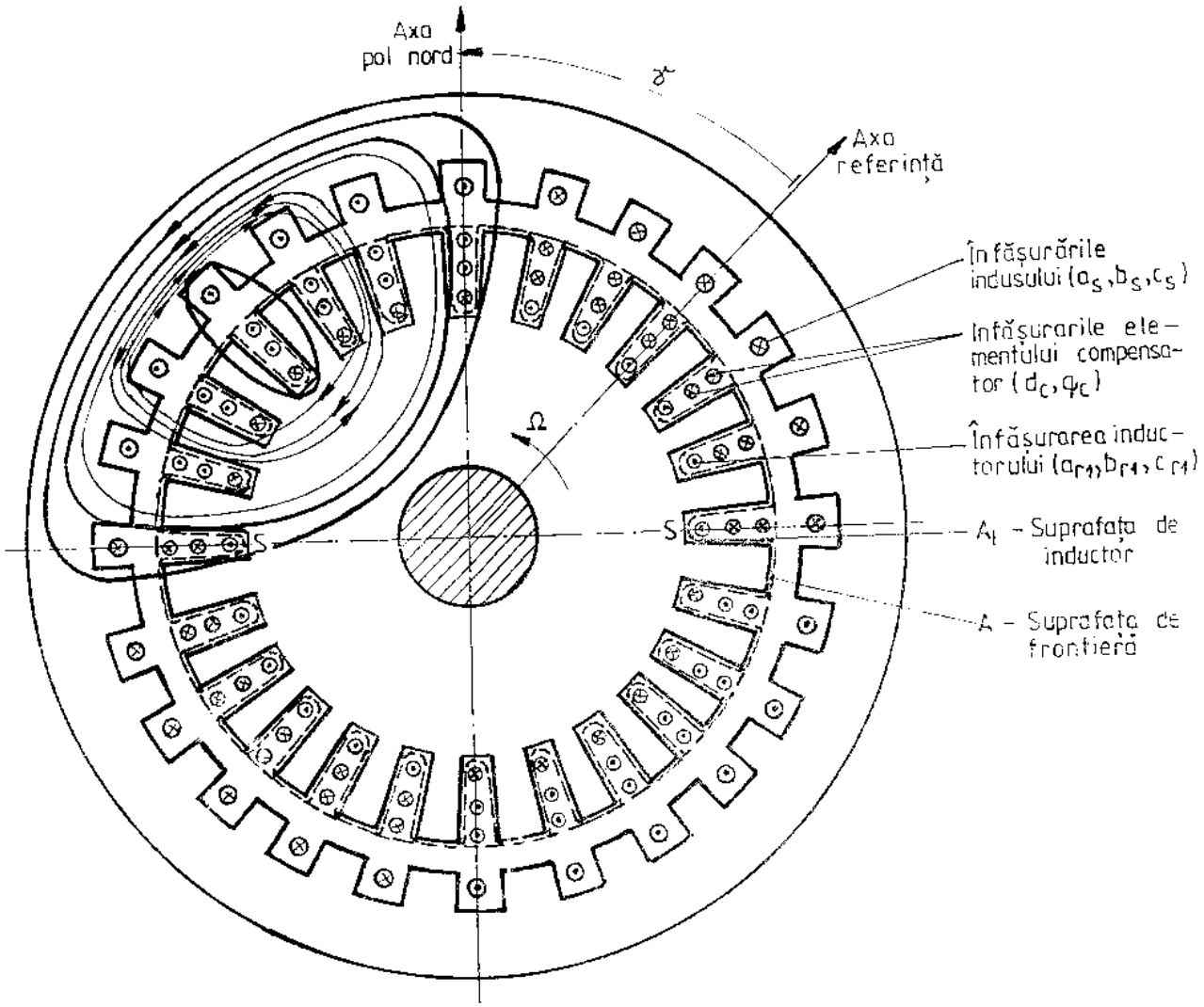

Fig.1.
Structural scheme of electromagnetic general system

The left member term represents the variation in unit time of electromagnetic energy within the entire volume V bounded by surface A.

The previous equation represents the following energetic balance: the electromagnetic energy accumulated within a given volume decreases because of Joule effect, another part is obtained through the overcome of impart forces $(\overline{E}_i)$, while another part is moving off from volume as radiation.

The method presented in this paper is based on closing into a circuit with feedback, shown in figure 2, the structural units of system and of the general equation, which permit optimal control of radiated power through frontier surface, which bound the volume V.

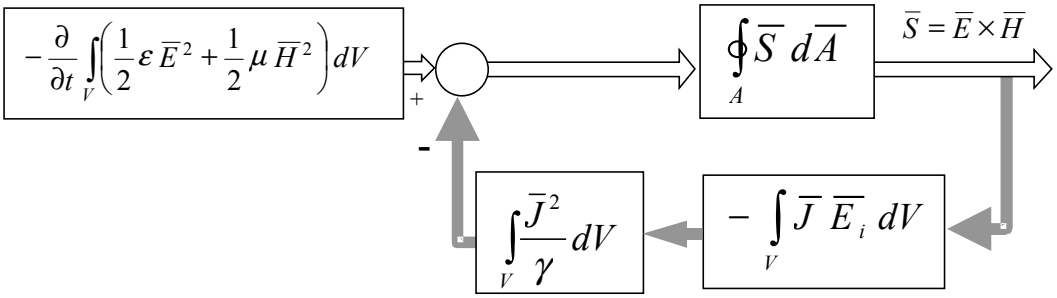

Fig. 2

The scheme points out the possibility to generate and regulate in optimal way the radiated power which passes through the machine's frontier surface (A) within a feedback circuit which controls the imparts fields $(\overline{E}_i)$, who supplies the compensation wraps of machine.

The objective function which provides the minimization of electric energy consumption of electromagnetic system is given by Hamilton's variational principle:

$$\delta\int_{t_1}^{t_2}\left\{\oint_A \overline{S}\,d\overline{A}\right\}dt=0$$

where the term in the brackets represents the radiated power (the lagrangean L of system) and the interval $[t_1\ t_2]$ corresponds to the action of impart field $(\overline{E}_i)$.

CONCLUSION

In this paper is presented the principle of an electromagnetic general system, complete automated, which permit the production and the optimal control of the reactive power through feedback control of the radiant power, determined by a Poynting's energy vector one way determined given by the frontier surface of the system.

REFERENCE

[1] Zărnescu H. Metodă şi sistem electromagnetic general automatizat. Summary of invention RO-96-01588A, published in BOPI 3/2000-