Provision of Throw-Over Manipulator and Step Conveyer with Sensor Controls

Firudin Mamedov[1], Tamella Ahmedova[2]
Sumgait State University, Sumgait, Azerbaijan
[2]*tamella.ahmedova@mail.ru*

***Abstract*— The paper deals with provision of throw-over manipulator and step conveyer with sensor control. A lower quality tuned circuit satisfying all the requirements for normal functioning of the system and robotics complex control is obtained on the base of lower magnetic permeability entire magnetic circuit.**

***Keywords*— step conveyer; throw-over manipulator; sensor control; tuned circuit**

The areas for transmitting the cards from the tube furnace outlets to card doubling process inlet are used in manufacture technology of evaporators of household refrigerators. In this area, a throw-over manipulator and a step conveyer that are represented in fig. 1, are applied.

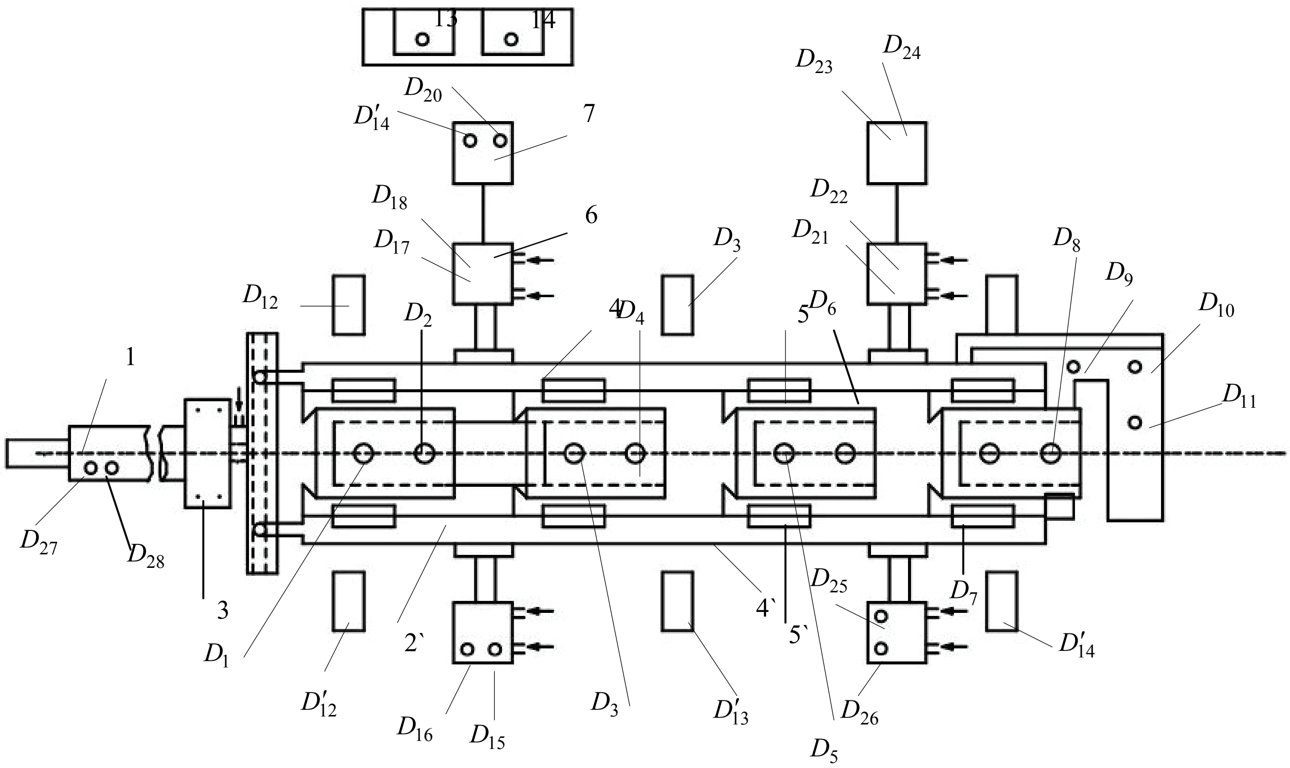

Figure 1. Construction of a step conveyer

In this figure, the standard and non-standard transducers are shown. The transducers D_1, D_2, D_3, D_4, D_5, D_6, D_7, D_8, D_9, D_{10}, D_{11} are non-standard. The transducers $(D_{12} D'_{12})$, (D_{13}, D'_{13}), (D_{14}, D'_{14}), (D_{15}, D_{16}), (D_{17}, D_{18}), (D_{19}, D_{20}), (D_{21}, D_{22}), (D_{23}, D_{24}), $D_{25}, D_{26}, D_{27}, D_{28}$ are feered contacts and define the state of pneumointigal. These transducers are standard ones produced in industry. The transducers 13, 14, control the state of the tube furnace conveyer. The throw-over manipulator and step conveyer system functions as follows. In the presence of the card with picture in the position 13 and 14, the tube furnace conveyer stops and the throw-over manipulator consisting of the pneumatic actuator 6 and the arm 7 takes this position.

The moving and fixed parts of the manipulator are symmetrically arranged on the arm 7. The moving parts are rigidly fastened to the arm of the pneumatic actuator 6. The fixed parts are rigidly fastened on the shoulders of the manipulator's arm. In the operation process of the manipulator, the cards are accepted from the sides by the sheets D_5, D_6 and D_7, D_8. In the absence of the cards with pictures, in the position D_5, D_6 the manipulator works and throws over the cards from the position 3 and 4, the cards appear in the position D_1, D_2, the step conveyer works at the position D_1, D_2 and by means of the pneumatic actuator that transfers the cards along the conveyer and carries the cards from the position D_1 and D_2 and positions D_5, D_6 and farther, the cards are doubled and handed over to the working table for further operation.

In the place of non-standard transducers, the inductive transducers with entire magnetic-circuit with frequency outputs [1] are used.

The principal block circuit of such a transducer is given in fig. 2.

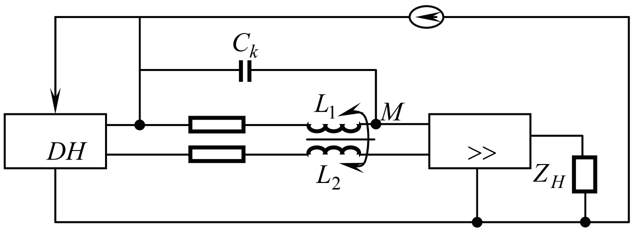

Figure 2. The principal block ciruit of the self-excited oscillator

The oscillation frequency of the self-excited oscillator is written in the form:

$$\omega = \omega_0 \sqrt{\frac{L_1(r_э + (r_2 + r_б)(1-\alpha))}{L_1(r_э + (r_2 + r_б)(1-\alpha)) + L_2 r_k (1-\alpha)}} \quad (1)$$

where L_1, L_2 are inductances of the tuned circuit coil $r_э, r_б$ are emitter and base contact resistances, r_2, r_k are ohmic resistance of the tuned circuit coil and resistance of the collector transition of the current gain factor of the transistor: ω_0 is an eigen frequency of the tuned circuit of the self-excited oscillator.

Here constant current operational amplifier with very great stress gain factor is used as an amplifier. It is always used with external, strong negative feed-back that defines its resulting characteristics. In the ideal operational amplifier we take $R_{вх} = \infty$, outlet stress gain factor $k_{Hb} = \infty$ and outlet resistance $R_{вых} = 0$. Furthermore, it is assumed that the common-mode rejection ratio equals infinity. In real operational amplifiers, we try increase maximally the inlet resistance and minimize the outlet resistance.

Usually, a differential amplifier is an input cascade of the operational amplifier. The outlet chain of the operational amplifier is represented in the form of outlet equivalent oscillator that develops stress proportional to the internal gain factor and stress difference with uninverting and inverting inlet. The outlet oscillator possesses the resistance $R_{вых}$. The self-excited oscillator of sinusoidal vibrations is constructed on the base of unconverting switching OY with the gain factor $K_u^0 = 1 + \frac{2R}{R} = 3$.

On the model of the self-excited oscillator, the chain is represented by the dependent source $k_u^0 u_{вх} = u_0$.

The gain factor of this chain is written in the form [1]

$$k = \frac{R}{(1 + j\omega CR)\left[\frac{R}{1 + j\omega CR} + R + j\left(\omega L - \frac{1}{\omega C}\right)\right]} \quad (2)$$

The calculation model is given in fig. 3.

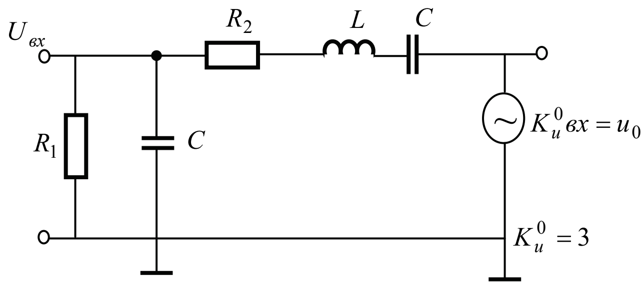

Figure 3. Figure 3. Equivalent scheme of the self-excited oscillator using OY

While creating a self-excited oscillator, it is convenient to choose variable resistances provided $R_1 = R_2 = R$. When such a condition is satisfied, the asymptotic diagram of chains of the self-excited oscillator is represented in the form of a graph shown in fig. 4.

The asymptotic diagram corresponds to the formula of k.

Performing some transformations in the last formula for the phase shift at resonance we get:

$$tg\varphi = \frac{\omega^2 c^2 R^2 + \omega^2 cL - 1}{2\omega cR} = 0$$

Hence we have:

$$\omega^2 c^2 R^2 + \omega^2 cL - 1 = 0 \quad (3)$$

Solving equation (3), we find $\omega_0 = \pm\sqrt{\frac{1}{C(R^2 C + L)}}$.

or

$$f_0 = \frac{1}{2\pi\sqrt{C(R^2 C + L)}} \quad (4)$$

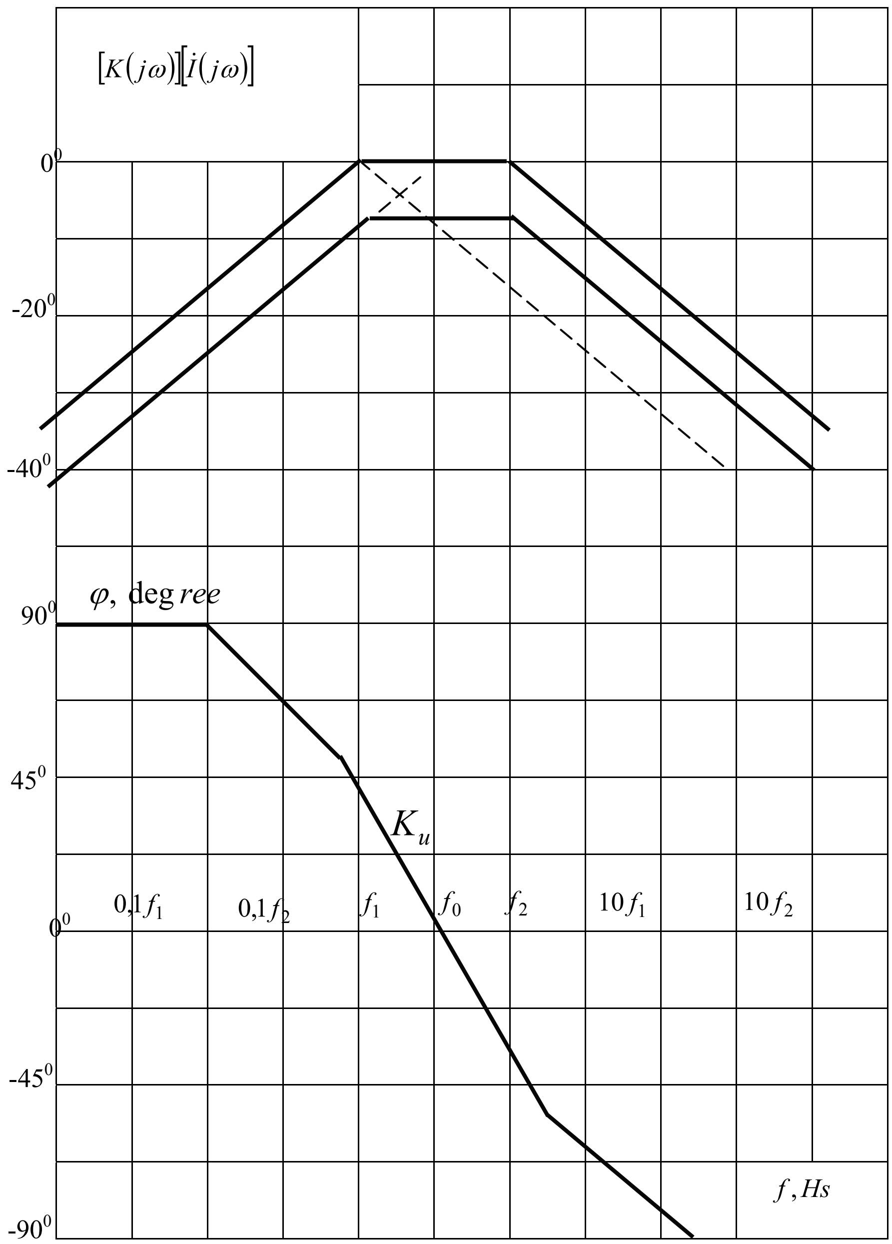

Figure 4. Asymptotic diagrams of the chains of a self-excited oscillator.

For a real circuit of the self-excited oscillator, the following inequality is always fulfilled: $L >> R^2C$

Therewith, the frequency of the oscillation of the output stress amplitude of the self-excited oscillator is written as follows: $f = \dfrac{1}{2\pi\sqrt{LC}} = f_0$

As it is seen from (4), the circuit of the self-excited oscillator is more sensitive to the inductance at higher frequency, and under lower frequency it is more sensitive to capacity change. In the considered informational-measuring system and control of robotics complex, a transducer with frequency output was created on the base of entire magnetic circuit with lower magnetic permeability that allows to get a lower quality tuned circuit. Under such situation, the relative small change of the current corresponds to wide range of the relative vibration of frequency that influences on gain factor change in the model of the self-excited oscillator.

References

[1] Aleksenko A.G., Shagurin I.I. Microcircuitry. M.: Radiosvyaz, 1982, 414 p (in Russian).

[2] Novitskiy P.V., Knopping V.G., Gutnikov V.S. Digital devices with frequency transduces. L. Energia, 1970, 423 p.

[3] Mamedov F.I., Ahmedova T.A. Determination of resonance frequency of self-excited oscillator of inductive distance transducer. Problems of energy, No 1, Baku, 200, pp. 95-100.