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SOFTWARE COMPONENTS OF THE SYSTEM FOR THE KINEMATIC AND DYNAMIC ANALYSIS OF MACHINES FOR SEWING, TEXTILE AND SHOE INDUSTRIES

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The equation of motion of link bring technological machines in the differential form has the form [1,3]

$$\left\{\sum_{k=1}^{n1}\sum_{i=1}^{n}[m_i(\frac{v_{iS}}{\omega_1})^2+J_{iS}(\frac{\omega_{iS}}{\omega_1})^2]\right\}\frac{d\omega_1}{dt}+\frac{d}{2d\varphi_1}\left\{\sum_{k=1}^{n1}\sum_{i=1}^{n}[m_i(\frac{v_{iS}}{\omega_1})^2+J_{iS}(\frac{\omega_{iS}}{\omega_1})^2]\right\}\omega_1^{\,2}= =\sum_{k=1}^{n1}\sum_{j=1}^{n}[F_{jS}(\frac{v_{jS}}{\omega_1})+M_{jS}(\frac{\omega_{jS}}{\omega_1})], \tag{1}$$

where n_1 – number of mechanisms, which are technological machine; n – number of links in the specific mechanism; m_i – mass of i - link; J_{iS} – the moment of inertia of the i - link relative to its center of mass; v_{iS} – the speed of the center of mass of the i - link; ω_{iS} – speed angular of i - link in about the center of mass; ω_1 – speed angular of link bring; t – time; φ_1- the angle of rotation of link bring; F_{jS} – resultant, given by the center of mass of the i - link power (includes moving forces, the forces of resistance); M_{jS} – resultant moment of all forces about the center of mass of the i - link[2].

Integrating the differential equation (1) we get the law of change of the speed angular of the leading link

$$\omega_1=\omega_1(t). \tag{2}$$

The current capacity for (2) equals

$$N=\sum_{k=1}^{n1}\sum_{j=1}^{n}[F_{jS}(\frac{v_{jS}}{\omega_1})+M_{jS}(\frac{\omega_{jS}}{\omega_1})]\omega_1(t). \tag{3}$$

Equation (3) can be used for automatic motor control technology machine.

To determine the components that are included in the differential equation (1), has developed a program for kinematic and force analysis of mechanisms of production machines. The basis of the program made calculations for three Assur groups, with a rectilinear motion of the output link, with the rotational motion of the output link, rectilinear and rotational motion of the output link. For each group defined the main kinematic parameters that were later used to determine the speed, accelerations and inertia forces.

For with a rectilinear motion of the output link three kinematic parameters, which are presented as a function of structural parameters of the group and of the kinematic parameters of the input link

$$\varphi_{p2i}=f1p(x_{Ai},y_{Ai},l_{2i},l_{3i},\varphi_{3i},l_{4i},\varphi_{4i}),\ \omega_{p2i}=f2p(vx_{Ai},vy_{Ai},l_{2i},l_{3i},\varphi_{3i},l_{4i},\varphi_{4i},\varphi_{2i}), \varepsilon_{p2i}=f3p(wx_{Ai},wy_{Ai},\omega_{2i},vx_{Ai},vy_{Ai},l_{2i},l_{3i},\varphi_{3i},l_{4i},\varphi_{4i},\varphi_{2i}). \tag{4}$$

For with the rotational motion of the output link of six kinematic parameters, which are presented as a function of structural parameters of the group and of the kinematic parameters of the input link

$$\begin{gathered}\varphi_{k2i} = f1k(x_{Ai}, y_{Ai}, l_{2i}, l_{3i}, \varphi_{3i}, l_{4i}, \varphi_{4i}), \omega_{k2i} = f2k(vx_{Ai}, vy_{Ai}, l_{2i}, l_{3i}, \varphi_{3i}, l_{4i}, \varphi_{4i}, \varphi_{2i}),\\ \varepsilon_{k2i} = f3k(wx_{Ai}, wy_{Ai}, \omega_{2i}, vx_{Ai}, vy_{Ai}, l_{2i}, l_{3i}, \varphi_{3i}, l_{4i}, \varphi_{4i}, \varphi_{2i}, \omega_{3i}),\\ \varphi_{k3i} = f4k(x_{Ai}, y_{Ai}, l_{2i}, l_{3i}, \varphi_{3i}, l_{4i}, \varphi_{4i}), \omega_{k3i} = f5k(vx_{Ai}, vy_{Ai}, l_{2i}, l_{3i}, \varphi_{3i}, l_{4i}, \varphi_{4i}, \varphi_{2i}),\\ \varepsilon_{k3i} = f6k(wx_{Ai}, wy_{Ai}, \omega_{2i}, vx_{Ai}, vy_{Ai}, l_{2i}, l_{3i}, \varphi_{3i}, l_{4i}, \varphi_{4i}, \varphi_{2i}, \omega_{3i}, \omega_{2i}).\end{gathered} \quad (5)$$

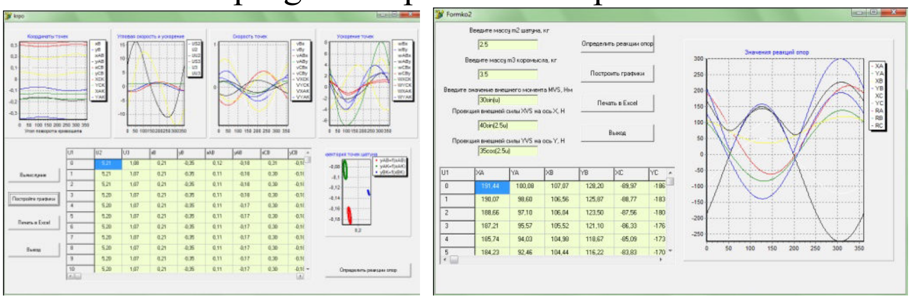
For rectilinear and rotational motion of the output link is the four kinematic parameters that are presented as a function of structural parameters of the group and of the kinematic parameters of the input link

$$\begin{gathered}\varphi_{u3i} = f1u(x_{Ai}, y_{Ai}, l_{3i}, l_{4i}, \varphi_{4i}), l_{u3i} = f2u(x_{Ai}, y_{Ai}, \varphi_{3i}, l_{4i}, \varphi_{4i}),\\ \omega_{u3i} = f3u(vx_{Ai}, vy_{Ai}, l_{3i}, \varphi_{3i}, l_{4i}, \varphi_{4i}), \varepsilon_{u3i} = f4u(wx_{Ai}, wy_{Ai}, vx_{Ai}, vy_{Ai}, l_{3i}, \varphi_{3i}, l_{4i}, \varphi_{4i}, \omega_{3i}).\end{gathered} \quad (6)$$

In expressions (4) to (6) φ_{p2i} ,ω_{p2i} ,ε_{p2i} , φ_{k2i} ,ω_{k2i} ,ε_{k2i} , φ_{u2i} ,ω_{u2i} ,ε_{u2i} designated rotation angle, speed corner and acceleration of the relevant elements of the considered groups.

The program develops 14 modules with forms Unit1PM.dfm, Unit2PM.dfm, kr0.dfm, kr1.dfm, kr2.dfm, ku0.dfm, ku1.dfm, ku2.dfm, po0.dfm, po1.dfm, po2.dfm, ko0.dfm, ko1.dfm, ko2.dfm. The algorithm provides for the sequential addition of the groups with the remapping of the kinematic parameters from the starting point of the previous group to the input position of the next group.

The main form of the program is presented in picture 1.



Picture 1 the Basic forms of the program

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