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SIMULATION OF THE PROCESING OSCILLATIONS

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Abstract: The causes which produce a step in the speed of centers of inertia in the element and the presence impulse of reaction are the elementary impact in the film couplings because of the supplementary relative movements allowed are the cowardly work.

1. THE PURPOSE OF THE FUNCTIONAL FORMING OPERATION OF THE PEAS SORTING MACHINE

In order to analyze the working of the peas sorting machine, considering the vibrations generated by the strip conveyer it would be useful to accomplish their mathematic design. The mathematic design is the basis of the elaboration of the program simulating the working of the machine. In this way, with the help of simulation, different working systems and the vibrations generated for different values of the working parameters can be studied. The working of the strip conveyer implies a dynamic and not geometrical drawing (as the drums of the strip are not cylindrical), that is necessary for the process of peas sorting. The complete elimination of vibrations and shocks is not possible, because of the fact that the sorting process itself is based on this kind of functioning.[1], [2]

2. DETERMINING THE MATHEMATICAL VALUE AND THE DIRECTION OF THE OF THE PEA'S SPEED AFTER THE IMPACT WITH THE SORTING STRIP

The simulation program accomplishes (on top of the diagrams of the oscillation process) the calculation for the trajectory of the pea after the impact with the transporting strip, considering also its complex oscillating movement. [4]

It is considered that the pea starts from a point above the strip, with the coordinates X_{ma0} and Y_{ma0} and has a geometrical drawing uniformly accelerated movement until the moment of its first impact with the transporting strip. The position of the pea $(X_{ma0}\ ,\ Y_{ma0})$ as well as its speed has to be calculated for each cycle of the simulation program separately.

Along with the movement of the pea, the movement of the sorting strip should also be taken into consideration. The mathematical values, as well as the direction of the speed of the sorting strip are calculated in the moment of collision. For this, the program detects the impact point M_a and the distance between this point and the point B. Because the length of AB segment varies, you have to establish the ratio k_{ma} , between the length of B_iM_{ai} segment and A_iB_i segment for the current cycle ("i") and then, using this ratio to calculate the position of point M_{ai-1} from the previous cycle. For this calculation you can use the formulas:

$$\frac{Y_{ma}-Y_{Bi}}{Y_{Ai}-Y_{Bi}}=K_{ma} \tag{2.1}$$

$$Y_{ma\,i-1}=K_{ma}(Y_{Ai-1}-Y_{Bi-1})+Y_{Bi-1} \tag{2.2}$$

$$X_{ma\,i-1}=K_{ma}(X_{Ai-1}-X_{Bi-1})+X_{Bi-1} \tag{2.3}$$

The meanings of the markings used in formulas (2.1 – 2.3) are shown in picture 1.

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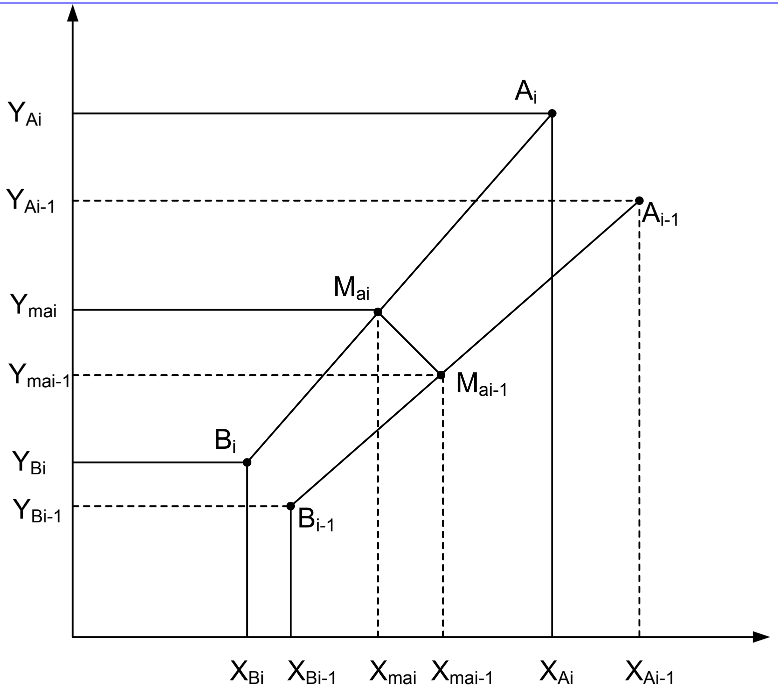

Fig.1. Distance of the contact

In picture 1 the distance that is covered by the contact point between two cycles of the program is (M_{ai}, M_{ai-1}), whose projections on the coordinates axis is:

$$\Delta X_{ma} = X_{mai} - X_{mai-1} \tag{2.4}$$

$$\Delta Y_{ma} = Y_{mai} - Y_{mai-1} \tag{2.5}$$

The position of the pea on the trajectory for the cycle "i" of the simulation program in given by the formulas:

$$X_{Mai} = X_{Mai-1} - w_{xmom}\, t \tag{2.6}$$

$$Y_{Mai} = Y_{Mai-1} + w_{ymom}\, t \tag{2.7}$$

Analyzing this trajectory for different parameters of the simulation (the revolution of the leaded drum, the drums' number of bars, different coefficients of refund), the mathematical values of this parameters, for which the sorting reaches its optimal level can be found. The results of the pea's trajectory simulation are presented, in the case of a 3-bar leading drum and 4-bar leaded drum. Simulations have been carried out for revolutions of the leading drum from 16 to 38 rotations/minute and for reimbursement coefficients of 0.3; 0.5, respectively 0.7.

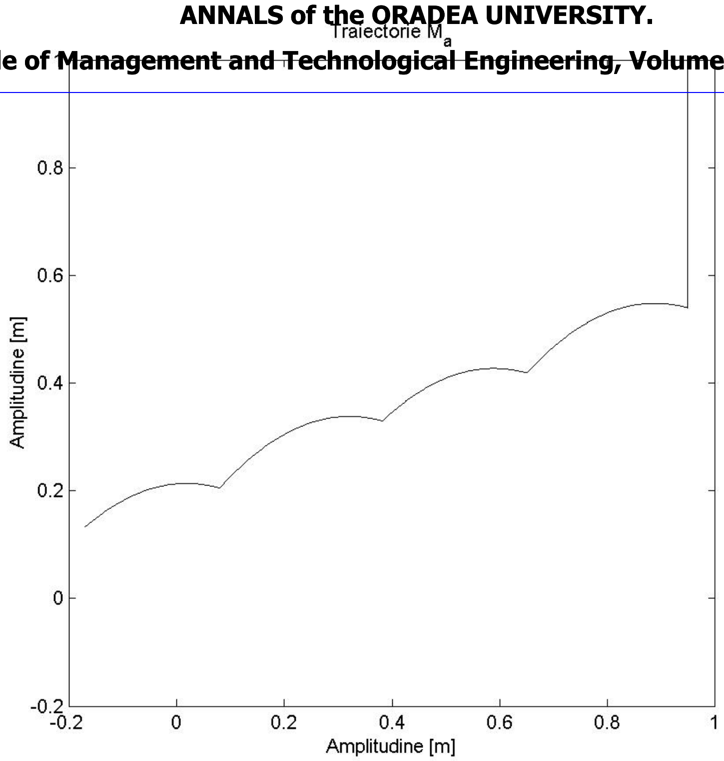

Fig.2a. The pea's trajectory for a leading drum's speed of 28 rot/min and a reimbursement coefficient of 0,3.

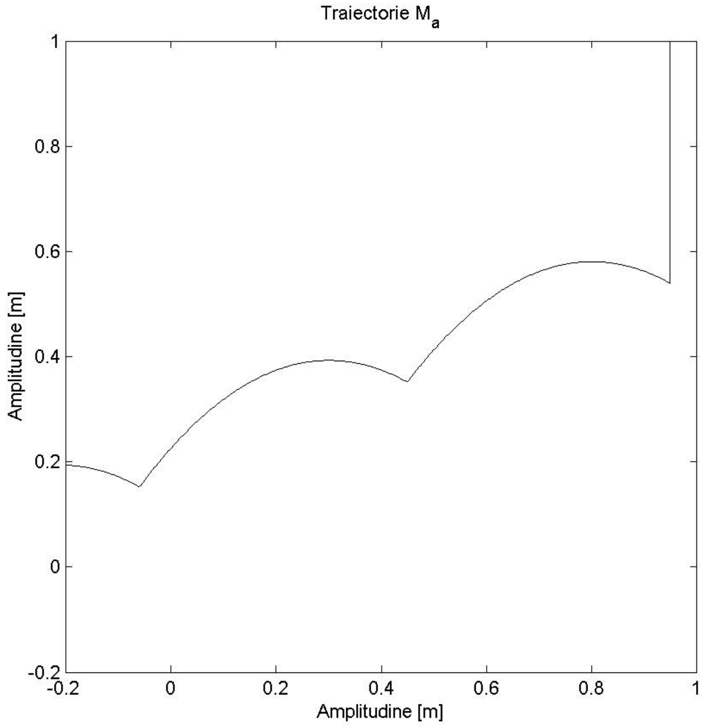

Fig.2b. The pea's trajectory for a leading drum's speed of 28 rot/min and a reimbursement coefficient of 0,5.

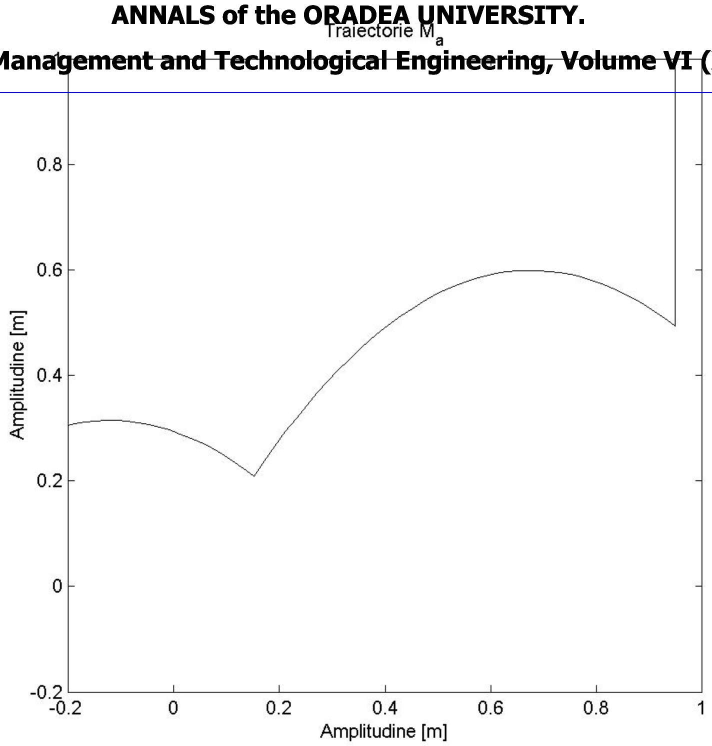

Fig.2[illegible]. The pea's trajectory for a leading drum's speed
of 28 rot/min and a reimbursement coefficient of 0,7.

3. CONCLUSIONS

From the diagrams presented in chapter 4 results that the sorting strip's oscillations are periodical, also having a periodical modulation of low frequency of the amplitude.

In this simulation, what was most in view was the effect of the leading drum's duration variation and of the reimbursement coefficient at the impact of the pea with the sorting strip on the pea's trajectory.

After analyzing the diagrams we realize that, generally, there is a light decrease in the number of collisions between the pea and the strip, once the revolution has increased. In some cases, still, for lower revolutions there is a larger number of collisions. The reason of the phenomenon is the way the pea's speeds and the sorting strips' compose in the first collision (in the moment of the impact, the strip can move in the same direction as the pea, and so the relative speed is lower).

As regards the influence of the reimbursement coefficient on the trajectory, it is noticed that for higher reimbursement coefficients (0,7) the number of collisions between the pea and the strip decreases. It is considered that the high quality peas have a higher reimbursement coefficients and the waste products (included the nods) have lower reimbursement coefficients (0,3). If the number of collisions between the pea and the sorting strip is low, the possibility that this will reached the end of the strip increases (this is the case of the high quality peas). The nods, impurities, and pour quality peas, that have a low reimbursement coefficient and a high number of collisions, will be transported by the strip to its higher side.

Comparing the influence of the revolution with the influence of the reimbursement coefficient on the trajectory of the pea, it is concluded that the reimbursement coefficients plays the most important part. The variation of the revolution has a lower influence, but can still be used to regulate the number of collisions between the pea and the sorting strip.

The drums' numbers of bars (comparing the diagrams for the case „3 and 4 bars" and the case „5 and 6 bars") influence greatly the value of the sorting strip's acceleration, the accelerations obtained in case „3 and 4 bars" being higher than the ones obtained in the case „5 and 6 bars". The explanation for this is that the more bars the drums have, the more circular they are, case in which the strip's oscillations amplitude would be 0.

Subprogram "calc_ma3"

```
% Calcul obiect ma
timp = timp + delta_timp;
D_ma_a = sqrt((X_ma - A(1,m))^2 + (Y_ma - A(2,m))^2);
D_ma_b = sqrt((X_ma - B(1,n))^2 + (Y_ma - B(2,n))^2);
D_ma_a_b = D_ma_a + D_ma_b;
D_a_b  = sqrt((A(1,m) - B(1,n))^2 + (A(2,m) - B(2,n))^2);
% Liniar
if liniar == 1
    X_ma = X_ma0;
    Y_ma = Y_ma0 - acc_grav*timp^2/2;
    v_ma =  acc_grav*timp;
    if abs(D_a_b - D_ma_a_b) <0.01
        liniar = 0;
        timp = 0;
        X_ma1 = X_ma;
        Y_ma1 = Y_ma;
    end
end
% Parabolic
if liniar == 0
    if timp == 0
        % Miscare bob de mazare
        v_norm_ma = v_ma*sin(teta_sis - gama);
        v_tan_ma  = v_ma*cos(teta_sis – gama);

        % Miscare banda
        k_ma = abs(X_ma - X_bi(i))/abs(X_ai(i) - X_bi(i));
        X_ma_a1 = k_ma*(X_ai(i-1) - X_bi(i-1)) + X_bi(i-1);
        Y_ma_a1 = k_ma*(Y_ai(i-1) - Y_bi(i-1)) + Y_bi(i-1);
        X_ma_a2 = k_ma*(X_ai(i) - X_bi(i)) + X_bi(i);
        Y_ma_a2 = k_ma*(Y_ai(i) - Y_bi(i)) + Y_bi(i);
        delta_X_ma = X_ma_a2 - X_ma_a1;
        delta_Y_ma = Y_ma_a2 - Y_ma_a1;
    X_ma = X_ma1 - wx*timp*coef_fr;
    Y_ma = Y_ma1 + wy*timp*coef_fr - (acc_grav*timp^2)/2;
    wx_mom = wx;
    wy_mom = wy - acc_grav*timp;
    if abs(D_a_b - D_ma_a_b) <0.01
         if wy_mom < 0
            timp = 0;
```

```
    v_ma = sqrt(wx_mom^2 + wy_mom^2);
    X_ma1 = X_ma;
    Y_ma1 = Y_ma;
  end
```

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