SOME CONSIDERATIONS ABOUT THE STUDY OF PARTICLES MOTION ON THE CONICAL SIEVES

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Abstract. In this paper, the oscillation amplitude is determined by the influence of vibration of conical sieve with experimental measurements for both experimental stand.
In order to determine the influence of vibration amplitude oscillations on the grid tapered experimental determinations were performed for both the experimental stand idle and when driving in pregnancy.
The amplitude of oscillation was changed by changing the length of the arm fastened to the screen and the proper positioning of the main drive mechanism so that the oscillation is conducted in a direction tangential to the screen, at a distance R (radius of the driving arm in a radial direction of the circle having mesh cone base).
With the help of the purchase made and the program developed in LabVIEW were purchased vibration signals to the four accelerometers placed on the surface of the separating grid.
Two accelerometers acquires the signal in the direction of the arm, and the other two in a direction perpendicular to the arm about the drive shaft.

Introduction

Vibratory movement is applied in practice in many fields, both for the transport of granular and powder products, or even in the form of pieces, as well as to complete the separation process.
In addition, the vibratory motion is used to evenly supply the material of the various separation equipment and process, as is the case for the equipment of the harvesting and processing of agricultural products, [4, 6, 8]
If machinery for agricultural products, oscillating body of work, its vibratory motion is achieved by switching to a rigid or elastic mechanism with the characteristics prescribed periodic motion, [5, 7]
The amplitude and frequency of the working depends on the kinematics of the driving mechanism.
Crank mechanism is the most common drive mechanism kinematic vibrating machinery.

Materials and methods

Separation conical surface is made of perforated sheet meal with circular holes diameter ϕ 4,2 mm and cone diameter at base ϕ 430 mm.
The steel cables diameter is ϕ 1,5 mm. The acting mechanism provides mostly an alternating circular motion of which amplitude can be measured to the edge of the sieve on both sides of the equilibrium position of oscillation. At this point an arm of length d is connected to the acting mechanism (horizontal oscillating circular saw).
The acting mechanism consists of an alternating current electric engine with a power of 710W and a worm-wheel drive with oscillating crank lever acting system. This one has the control button eccentrically disposed on the worm wheel of the transmission mechanism.

The oscillating crank lever stroke of the acting system is of 16mm. The slider arm is joined by a spherical joint on the arm stiffened with the sieve and it is laid on radial direction to the base circle of the cone.
Scheme of experimental installations is shown in Figure 1.

Figure 1. Experimental stand

The experimental equipment is provided with the possibility to set the oscillating motion parameters namely the oscillation frequency F, and the oscillation amplitude A_i.
Oscillation frequency can be changed from the electric motor by varying the electric current parameters. The oscillation amplitude can be modified by changing the position of acting mechanism in relation to the radial arm of the sieve, joined one to the other by a spherical joint, [1].
By the eccentric tangential positioning of the arm joint of acting mechanism to the conical sieve, it develops almost circular oscillations towards the vertical axis of the cone. This motion is assumed to be oscillatory, because the vertical axis of the sieve (its center) was not constrained to move in the direction of the arm joined with the sieve (placed radial at the base circle of the cone).
The designed and experimentally developed equipment was used both to determine the vibratory motions of the separation surface (as an agricultural products processing element) and to estimate the material movement on the sieve and the separation and seed crops sorting process efficiency, [3].
Experimental stand is provided with the ability to set parameters, namely the oscillating movement of the oscillation frequency, oscillation amplitude F and Ai. Oscillation frequency can be changed from the electric motor by varying the electric current parameters and the oscillation amplitude can be changed by changing the position of arrangement of the drive mechanism in relation to the radial arm of the sieve.
For experimental determinations was used as a chain composed of the following devices: card National Instruments data acquisition, four 4508B Brüel & Kjær accelerometers with magnetic fastening and metal clip, computer software Labview data acquisition and processing; radial arm jointly sieve about the possibility of four-point swing arm ram to obtain four different values of oscillation amplitude, single-phase electric motor speed control can offset and worm gear drive system with swing and slide,
To achieve the four measurements used accelerometers were placed two by two diametrically opposed to the center of the filter being able to determine both the direction tangential vibration and the radial direction.
Measurements were made both idle and full load for the two directions, both radially (accelerometers 4 and 2), as well as the tangential direction (accelerometers 1 and 3) as shown in the way of settlement accelerometers shown in Figure 2.
Four accelerometers were connected to data acquisition card through a computer set with printer for plotting graphs acquired signals.

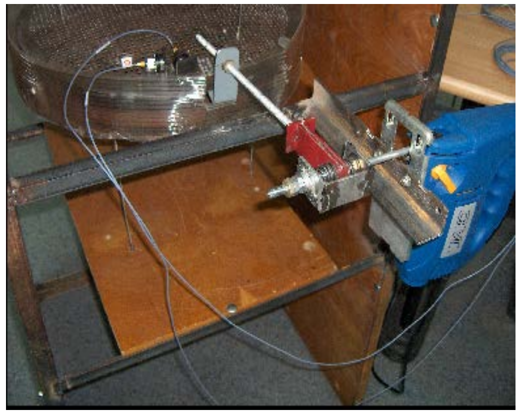


Fig.2. Positioning accelerometers

Before each sample were appropriately modified kinematic parameters of the oscillating sieve namely that the oscillation frequency of the oscillation amplitude.
Signal acquisition was done through LabVIEW, [3], data acquisition was performed before the program structure by which the purchase was made and signal processing.

Results and discussions

Oscillation amplitude was modified by altering the length of the arm reinforced with mesh and proper positioning of the main drive mechanism, so that oscillations are driven in a direction tangential to the screen at a distance d (radius of the actuator arm radial direction with the circle base of the cone filter).

With the acquisition system developed and the program developed in Labview, vibration signals were acquired at four accelerometers positioned on the dividing surface of the screen. Two accelerometers buy signal on the arm, the other two, in a direction perpendicular to the arm about the drive shaft.

Measurements at idle were performed only for the oscillation frequency f2 = 8.6 Hz, three arm lengths of the filter, while the full load measurements were performed with rapeseed three oscillation frequencies (f1 = 4.1 Hz, f2 = 8.6 Hz, f3 = 13.1 Hz) and three different lengths of arm filter (d1 = 480 mm, d2 = 460 mm, d3 = 420 mm).

Based on the analysis of acceleration signals acquired and presented table 1 sinusoidal oscillations variation is found for the four accelerometers.

This is profoundly visible accelerometer mounted near a site that acquires signal arm tangential direction (perpendicular to the mean position of oscillation of the arm mesh). For idling, amplitude purchased the oscillation frequency f2 = 8.6 Hz, is inversely proportional value with mesh arm length d Thus the accelerometer 1, the amplitude of oscillation reaches maximum acceleration, order of 100 m/s2, the overall oscillation type sinusoidal with minor disturbances related to elastic suspension system and own vibration sieve.

The arm length increases, the acceleration amplitude of the filter decreases to below 50 m/s2 at an arm length of 480 mm with deeper overall vibration disturbance superimposed oscillation.

Table 1. Analysis of acceleration signals

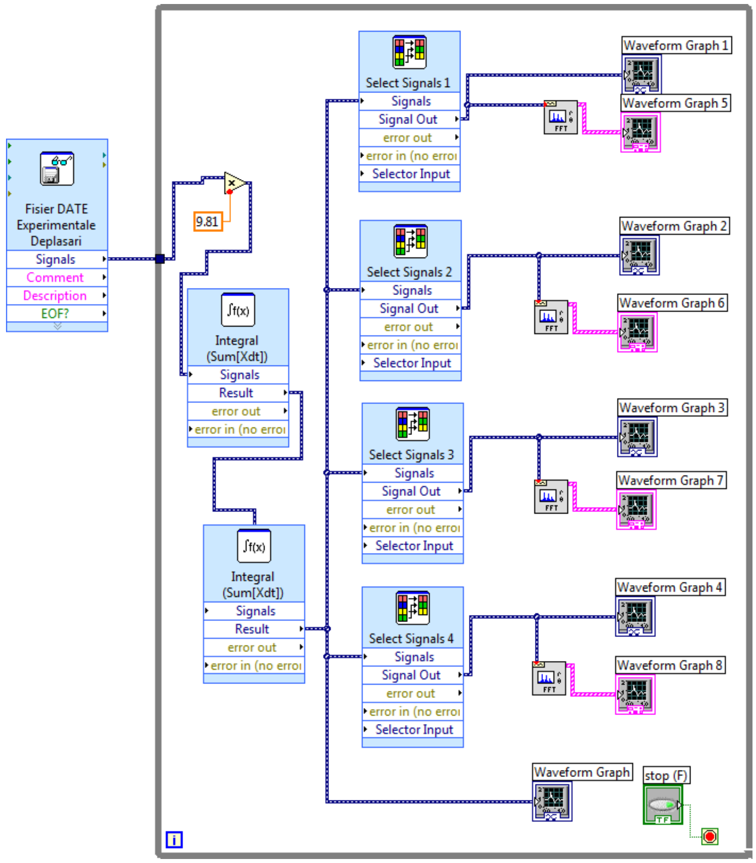
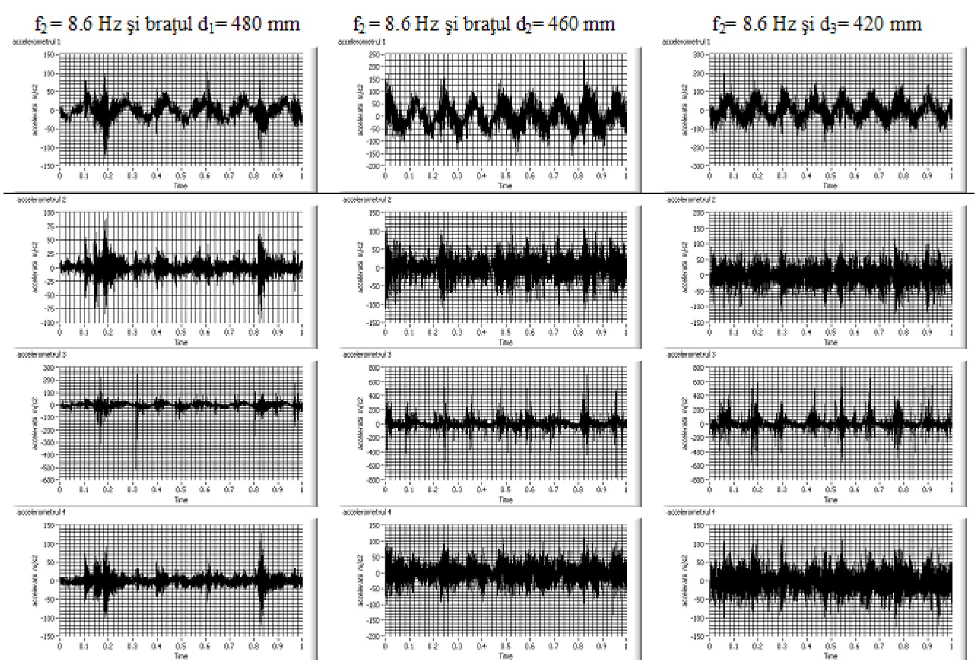


Table 2. Load variation acceleration filter F2 = 8.6 Hz frequency for three different lengths of arm drive



At the accelerometer 3 signal acquiring all three of the tangential direction (perpendicular to the arm mesh) but found a greater distance from the point of operation, general oscillation, although it is obvious sinusoidal type, is not as pronounced as the accelerometer 1, being more flattened, but in this case, acceleration amplitude of oscillation, decreases with increasing arm length filter, the average value of about 100 to below 50 m/s2 m/s2 for arm length of 420 mm.

It also notes the existence of interference oscillations caused by factors other than printed oscillation mechanism.
At 2 and 4 accelerometers that acquires signal radial direction (ie parallel to the arm mesh) located at about the same distance from the point of operation, sinusoidal oscillations general are not as visible as the 1 and 3 accelerometers and vibration disturbance are more pronounced.

CONCLUSION

Conditioning technologies are quite different when it comes to the final destination of seeds under some specific operations are present in the flow conditioning technology and new ones may be added depending on the physico-mechanical properties of seeds and special needs conditioning.
Separation of mixtures of seed foreign bodies is based on differences in physical characteristics of seeds and foreign material (size, aerodynamic properties, coefficient of friction, elastic properties, shape, density, color, etc).
Separation surface oscillations is characterized by its basic parameters: oscillation frequency and oscillation amplitude, must be considered and other parameters relating both to process and the characteristics of the material to be machined: the angle of the site coefficients friction, optimal speed and speed limit imposed screening passes through interactions between particles, interactions with surfaces sifting energy consumption in processing, size and shape hole separation.

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