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Detection of physical parameters on skidding line at manipulation of logs

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Abstract: *Detection of physical parameters on skidding line at manipulation of logs.* The Article deals with interaction of oscillation double-drum winch Adler, which draw force is 80 kN on forest wheeled skidder HSM 805. The aim was to analyze relative bonds and possibilities to reduction of ergonomical indicators, which are coupled with kinematical and dynamical parameters of the each elements of the whole system.

Keywords: winch, physical parameters, manipulation, log, forest wheeled skidder.

INTRODUCTION

The work on the mobile energetically machines is bearing the negative effect in form of commotion, percussion, oscillation and wiggle. When the operator is working long time, he feels the tiredness. His attention and production rate are by the long work enormous. The reaction time is lengthening. The oscillation is through the variable loading fluency the running hours of the machine and the parts. The parameters of oscillation and shakes influenced also on the manipulation continuity of roundwood. The monitored parameters of material flow are: quantity of material, time, trajectory, velocity and acceleration [2].

MATERIAL, METHODS AND RESULTS

From the viewpoint of complex checking spotted physical parameters by the manipulation with the wood materials were measured the flows of acceleration and traction force by the skidding throw the winch (Fig. 1). On the winch was assembled three axis sensor of acceleration 3D-BTA fy Vernier (Fig. 2) and the traction force was noticed with the sensor of forces LC- IE – 200kN fy Kosík a Spevák (Fig. 2).

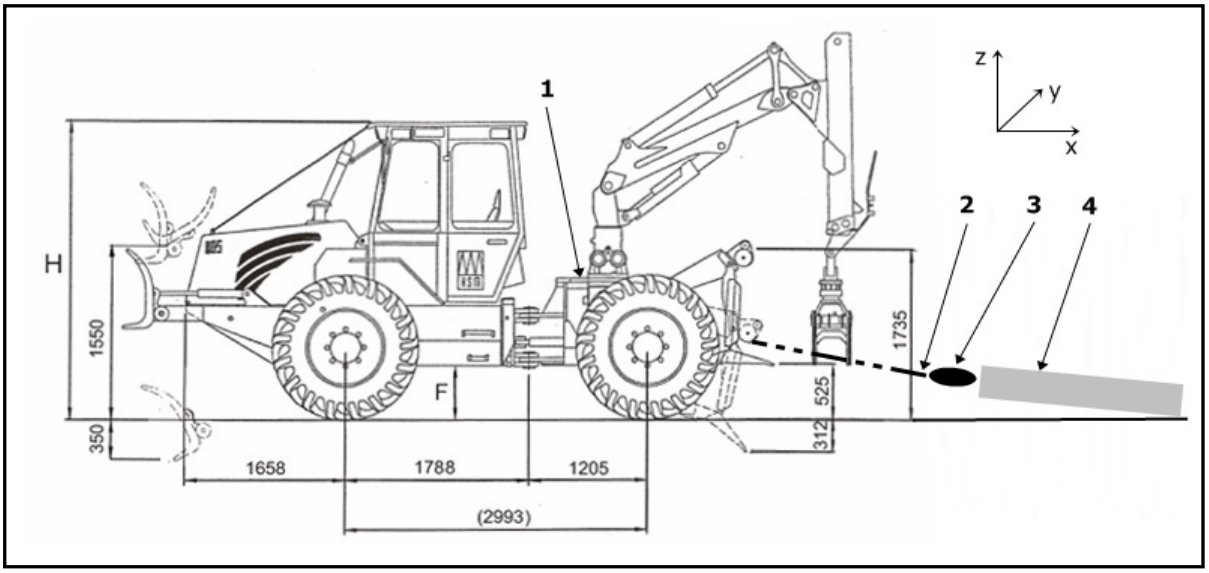

Fig. 1. Schema of the work by the skidding
1 – acceleration sensor, 2 – rope, 3 – force sensor, 4 – log

Fig. 2. Realization of experiment by skidding
1 – acceleration sensor 3D-BTA, 3 – force sensor LC- IE – 200kN

The realized record was processed with the program LabView. In the experiment carried out five measurements, which are necessary to calculate the frequency distribution depending on the time. It was made with the help of FFT analysis. The next was important to support the stationary and ergodicity of the process. By the measures was this confirm with statistic method ANOVA. Using LabView software the acceleration in each axis was calculated (Fig. 1) using the formula (1), and then calculated the final weighted vibration acceleration (2).

$$a_w = \sqrt{\sum \left(W_i\, a_i\right)^2} \tag{1}$$

a_i – valued effective acceleration for i-zone ($m.s^{-2}$)
W_i – weight factor for i-zone

$$a_v = \sqrt{k_x^2\, a_{wx}^2 + k_y^2\, a_{wy}^2 + k_z^2\, a_{wz}^2} \tag{2}$$

$a_{wx,y,z}$ – valued effective accelerations to the coordinate system x, y, z ($m.s^{-2}$)
$k_{x,y,z}$ – multiplications constants

After application of Butterworth filter for elimination parasitic noise, was the dependencies of the result acceleration, the filtered acceleration and the flow of traction force presented on the (Fig. 3). From this (Fig. 3) is liquating that by the change of the traction force is the acceleration flow changing.

To the important physical parameters also belongs change of acceleration and velocity (Fig. 4).These parameters are together re-bound with derivation and integrations relationships. These dependencies can be described with the numerical mathematic, where the change of velocity is (3) and velocity (4). The step of function *h* is constant (*h = 0,005*) [3].

$$f'(x) \approx \frac{1}{h}\left(f(x+h) - f(x)\right) + f(x-h) = \eta(x) \tag{3}$$

$$\int_a^b f(x)dx \approx \frac{h}{2}\left(f(x) + f(x+h)\right) + f(x-h) = \psi(x) \tag{4}$$

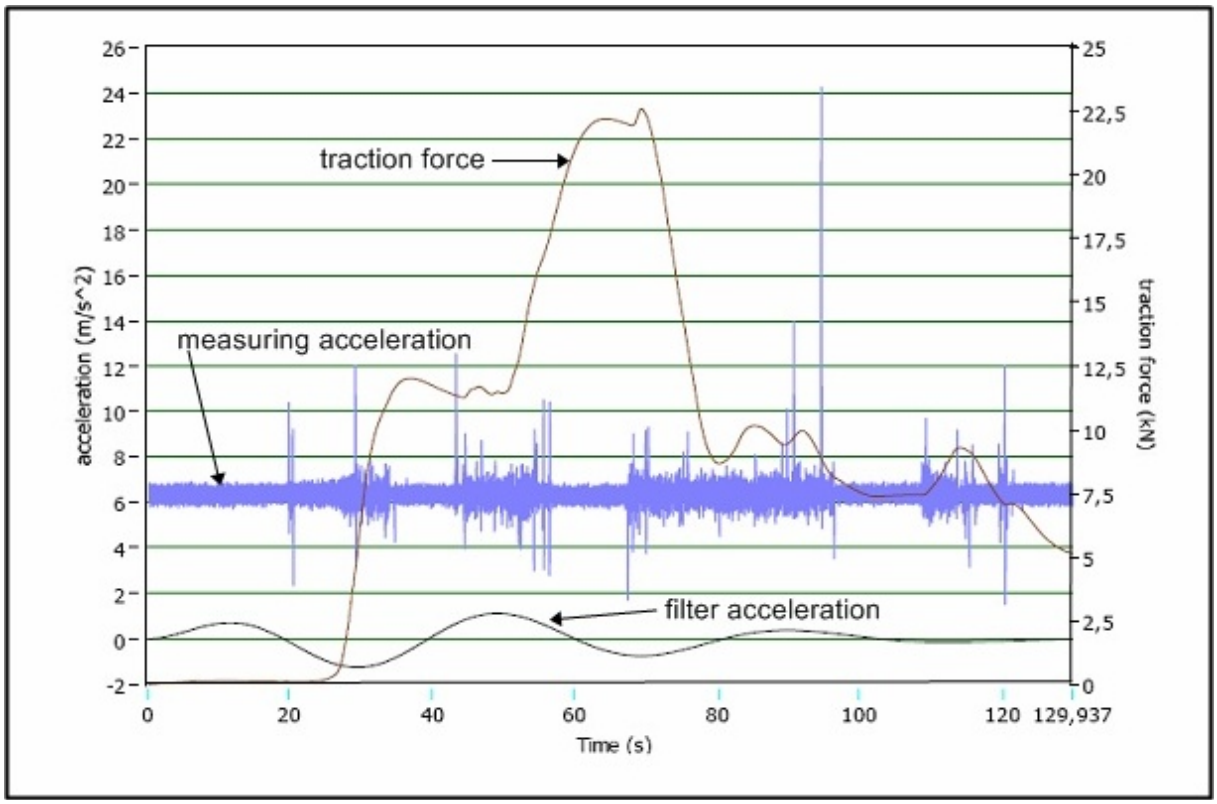

Fig. 3. Dependence of acceleration from traction force

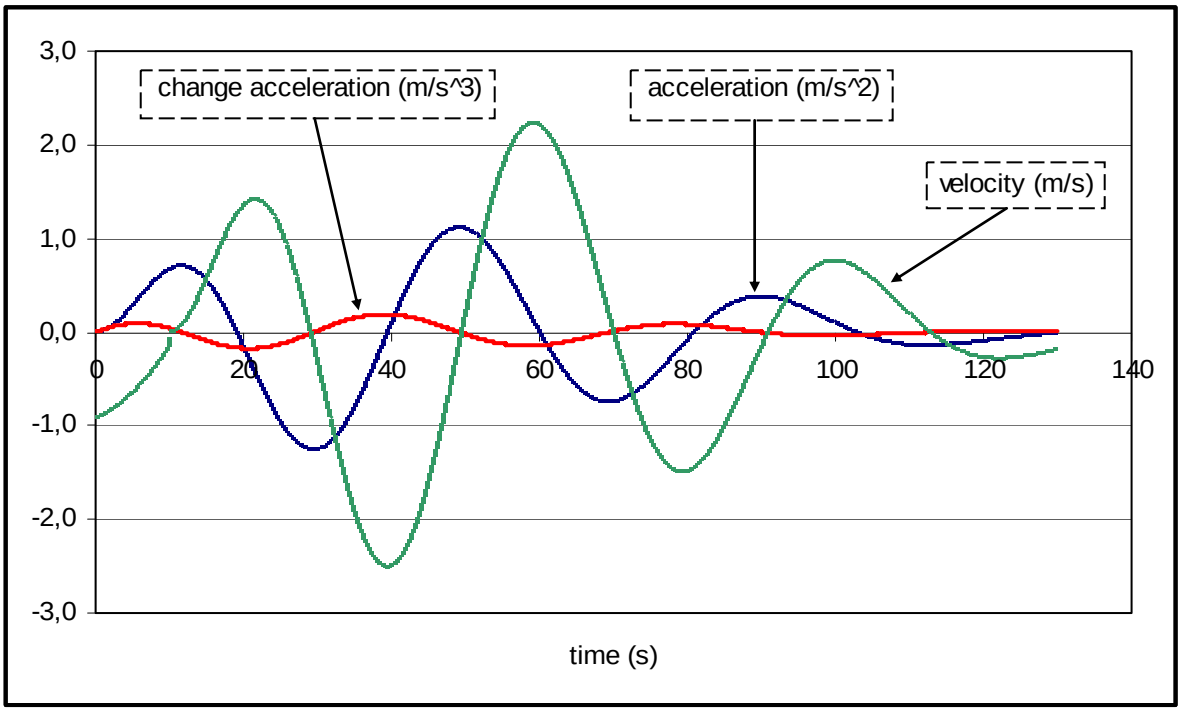

Fig. 4. Flow of kinematical values by the skidding

CONCLUSION

On the basis of conducted research it can be stated, that on vibration at work of winch affects the length of the winch rope and the pulling speed. We can not forget that the logs size and the terrain form are very important factors by the design of the technical and construction solution forest wheeled skidder. On the basis of measurement and evaluation of data analysis it can be analysed the impact of the parameters on the performance and durability of device and thus its ability to manipulate of roundwood.

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Streszczenie: *Wyznaczanie parametrów fizycznych pracy wyciągarki w trakcie zrywki drewna okrągłego.* Praca dotyczy oddziaływania drgań wyciągarki do kłód Adler o sile uciągu 80 KN na zrywarkę dłużyc HSM 805. W ramach pracy analizowano rzeczywiste powiązania i możliwości obniżenia wskaźników ergonomicznych wynikających z parametrów pracy urządzenia.

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