The 4th International Conference
″Computational Mechanics
and Virtual Engineering″
COMEC 2011
20-22 OCTOBER 2011, Brasov, Romania

DYNAMIC AND ENERGY MODELING OF THE ACTIVE ELEMENTS FROM COMPLEX AGGREGATES TO SOIL PREPARED.

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***Abstract**: Tis paper presents a method to measurement the forces, the stress and strain that occurring to the active organs of the complex aggregates for to the soil prepared. For measuring the torque, the stress, the angular speed of the tractor PTO, shaft a torque and angular speed transducer was performed. It was mounted between tractor PTO and agricultural machinery. For determining the distribution of the tractor power on to the driving axis a torque and angular speed transducer was performed and mounted on the cardan shaft transmission of the driving axles. For measurements the forces and strain that in agricultural machinery performed, was construction a intermediate frame with tens metric rings and angular transducer.*
This equipment is enabling to simultaneous measurement of the following parameters: connecting forces between tractor and machine, the torque transmied to the machine by PTO, shaft and the torques transmitted to the tractor driving axis.
***Key word**: dynamic and energetic; agricultural machine and soil.*

1. INTRODUCTION

The research of the tractor and agricultural machinery that in the No-tillage system working, has as role to determining the characteristic, dynamic and energetic parameters behavior of the system which consisted of four wheels drive tractor model Holland T6070 and agricultural machinery tip ELS 4. The experimental research had as purpose the determination of the following main parameters: forces which act on the rear tree points hitch of the tractor; torsion moments that was transmitted to the drive axis of tractor; the torsion moments transmitted to the machine trough the PTO, slip of the rear axles of the tractor; The tractor energy and power consumption for traction and driving trough the PTO.
The determination of followed parameters (forces, torsion moments, rotation speed, traveling speed and more) was made through electric and electronic methods which present advantage of a simple and fact assemblages and high precision of measuring and allows the possibility for simultaneous data acquisition measurements parameters.
Equipment and methodology for experimental research:

2. METHODS FOR MEASUREMENT

The measurement of linking forces between tractor and agricultural machine was performed through a intermediate frame with tens metric transducers (resistive and inductive), that was built specially for these measurements to a INMA Bucharest workshop. It was presented in figure 2.
The space S_r passed by tractor and machine system during the travel is determined by relationships:

$$S_r = \frac{2\pi r_z N_{rz}}{Z_{rz}} \quad [m] \qquad (1)$$

and linear speed of tractor and machinery is calculated by :

$$v = \frac{2\pi r_z N_{rz}}{Z_{rz} \cdot t} \quad [m/s] \qquad (2)$$

where : r_s is the dynamic operating radius of the machinery wheel Nrs. is the number of the transducers impulses. Z_{rs} is the number of indentation of the disc transducers.

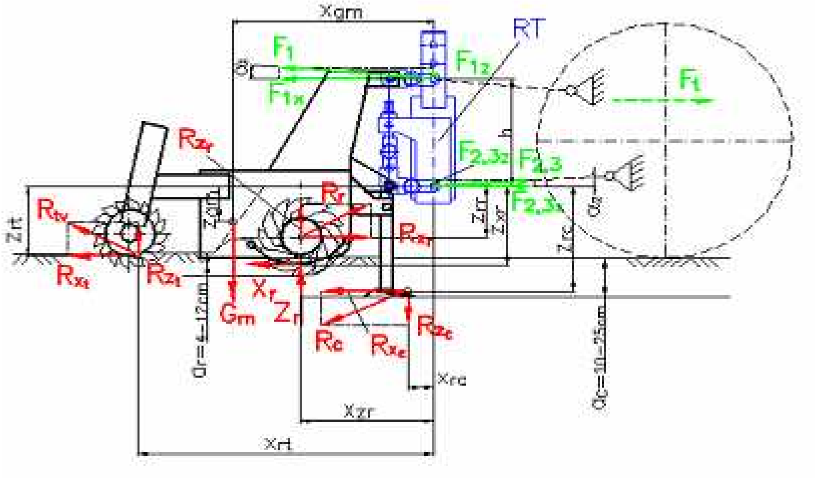

Figure1. Location scheme of transducers and sensors on tillage machine system and forces acting rear three points hitch of the tractor.

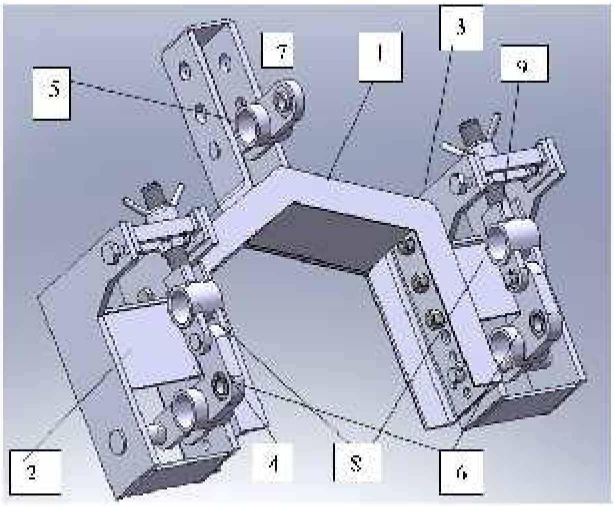

Figure 2. Intermediate tens metric frame.
1. Central frame; 2.Lateral frame; 3. Lateral frame; 4. Lateral pin; 5. Central pin;
6. Horizontal supports; 7 Central supports strain gauges; 8. Top pin; 9. Vertical supports strain gauges.

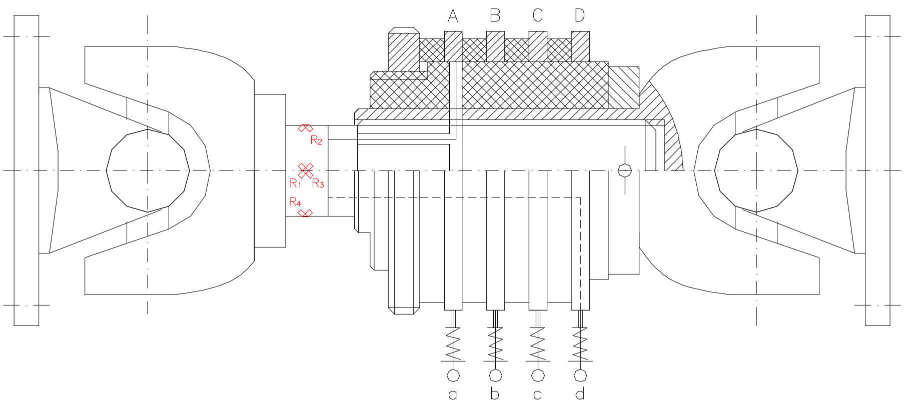

Figure 3. Location scheme of transducers and collector with contact sliders for torsion moment measuring to the PTO shaft.

The device is made with 3 frames and 5 strain gauges support which can be assembled in three positions, making it is possible to couple to the suspension mechanism at 3 hitch points. The frame is coupled to the rear three points hitch of the agricultural tractor with bolts to the lateral and central supports.
For measurement of the torsion moments from PTO shaft is used methods based on electro -resistive transducers (TER). To perform measuring device based on this method, on measuring axel (figure 3) are applied four transducers $R_1:R_2:R_3:R_4$ in to the scheme tens metric ring (figure 4). These transducers were connected into Wheatstone bridge to the feeding installation (power-supply) and the measuring tension is performed with the help of the collector with contacts sliders (Figure 3).
For the measuring of the rotation speed of the PTO shaft, used a variable reluctance sensors.
The dynamic and cinematic experimental data transmitted by the sensors and transducers were collected according to the measurement linkage (Figure 5). For this purpose was used data acquisition system DAP 1200, available at the National Institute for Agricultural Machines INMA Bucharest.

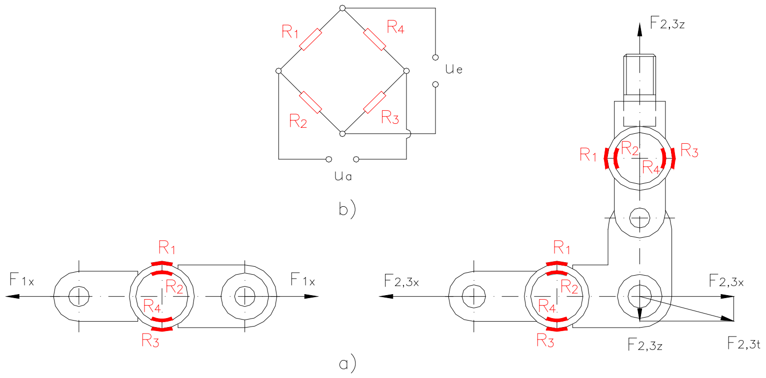

Figure 4. Scheme of tens metric ring for forces measuring of the rear three points hitch of the tractor.

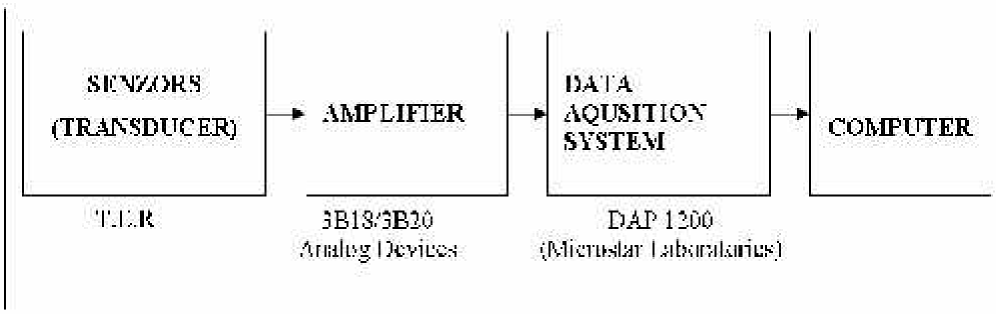

Figure 5. The block diagram for collection, acquisition and data processing.

The following graphs present the variation curves of traction forces in time at 50 sec. The experimental research was made for the working depth of knife $a_c = 16\ cm$ and a rotor knife $a_r = 4cm$. Was made experimental research for 3 values for traveling speed 0.90 m/s; 1.42 m/s and 2.17 m/s.

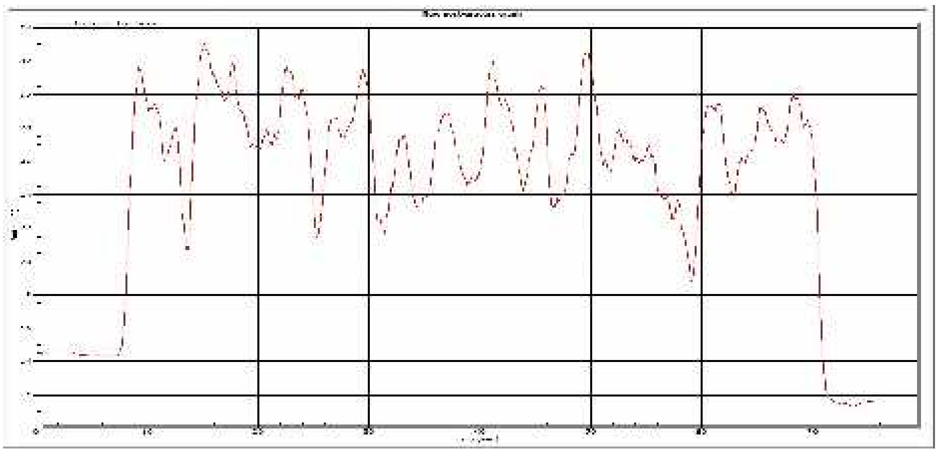

Figure 6. Graph of traction forces for 0.9 m/s traveling speed.

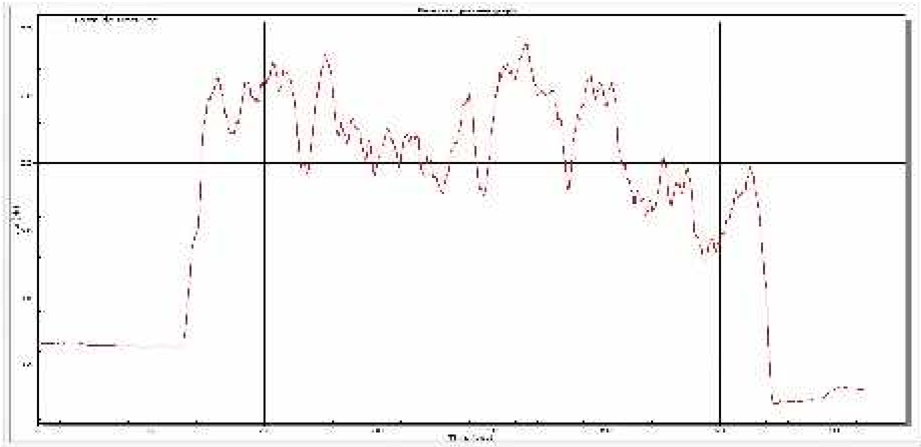

Figure 7. Graph of traction forces for 1.42 m/s traveling speed.

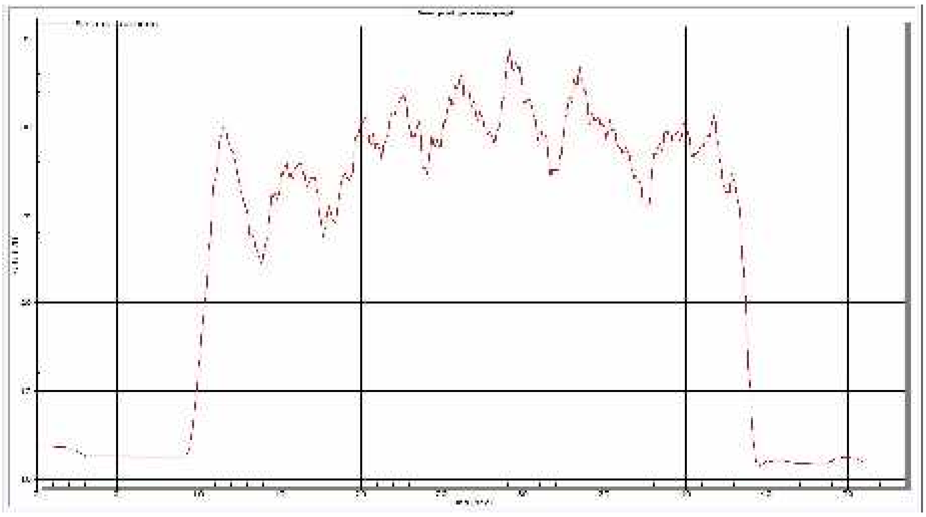

Figure 8. Graph of traction forces for 2.17 m/s traveling speed.

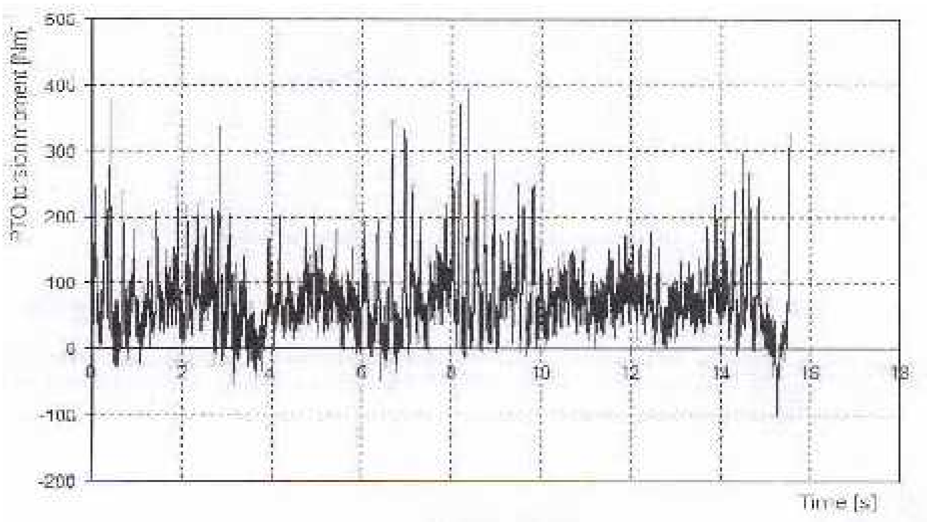

Figure 9. Time variation of moment of torsion at PTO shaft to operate at rotation speed 1054 rot/min and tractor speed of 2.17 m/s.

3. CONCLUSIONS

- By means of tensile frame mounted on three points-suspension system of tractor, the resistance force of agricultural machines coupled to tractor is controlled.
- By measuring the tractor total forces of traction and PTO shaft torsion moment, we can determine the power consumed for the agricultural machines.

➢ Analyzing the energy consumption of agricultural machine, in relation with to traveling speed, results that the traveling speed for the unit "no-tillage" is determined by the technical requirements needed to execute the works and has a minimal effect on energy consumption.

ACKNOWLEDGEMENT:
This paper is supported by the Sectoral Operational Program, Human Resources Development, (SOP-HRD), financed from the European Social Fund and the Romania Government under contract number: POSDRU 6/1.5/S6.

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