A MOBILE TESTING SYSTEM FOR VEHICLE PERFORMANCE ESTIMATION

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Summary: In this paper a mobile testing system for vehicle performance estimation is described. It enables data acquisition about speed, accelerations, relative displacements, pressures, forces influencing on the vehicle. Data acquisition realized by sensors located at different places in the vehicle. The system enables to do records, fast visualization and processing of the experimental data.

INTRODUCTION

The continuous development of vehicle construction needs of testing new production in laboratory and road conditions. In the past they used for testing in road conditions heavy, large and complex testing devices and facilities. More of its ware analog devices which need a long time preparation before doing the experiments and a difficult processing of collected data [1, 2].

Today the old installations are history. Many companies offer to the market a great number of small testing modules with digital data processing and possibility for fast visualization of results, sensors for different applications (including “smart” sensors). In this situation is not very difficult to choose components and compile a testing system for specific application - for example in vehicle testing.

The goal of presented paper is to describe a mobile vehicle testing system, developed in University of Ruse, Department Automobiles, Tractors and Fork-Lift Trucks.

DESCRIBTION OF THE TESTING SYSTEM

Initially, before compilation of the testing system, an analysis about during different vehicle tests was done. Most often measured vehicle characteristics are:

- speed;
- acceleration;
- fluid or air pressure;
- forces;
- displacements.

According this fact we choose components and compile a computer based testing system with universal application in vehicle tests. The structure of system is shown on the Fig.1.

The main components of the system are:

- mobile computer (Lap-top) HP;
- 2 National Instruments’ DAQ USB-6008 and USB-6009 placed in safety boxes;
- 3 pressure sensors - one with range 25 MPa and two with range 10 MPa, error <1%FS;
- 2 displacement sensors with ranges 100 and 300 mm, error <0,45%FS;
- 3 acceleration sensors for all 3 axes – one with range ±10g and two with range ± 2g, error < 0,7%PE ;
- 3 force sensors with range 500, 10000 and 20000 N, each one with individual transducer; combined error <1% FSO ;
- radar speed sensor with range 0-480 km/h and digital output, error ±0,34% + 0,0023%/Mph.

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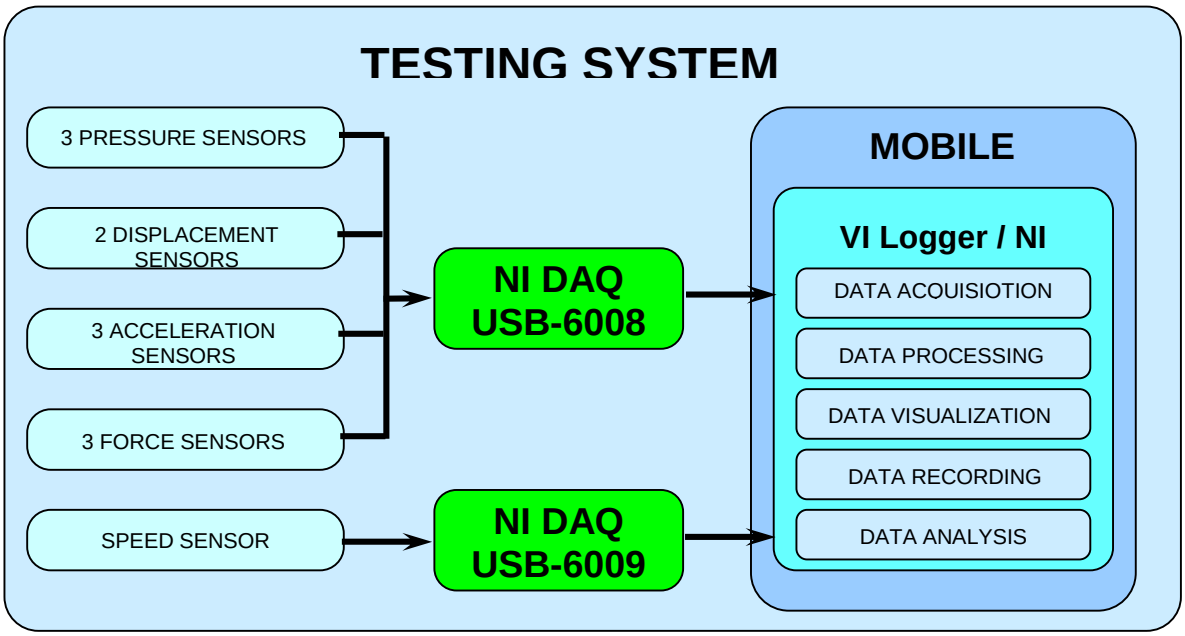

Fig.1. Structure of the mobile testing system for vehicle performance estimation

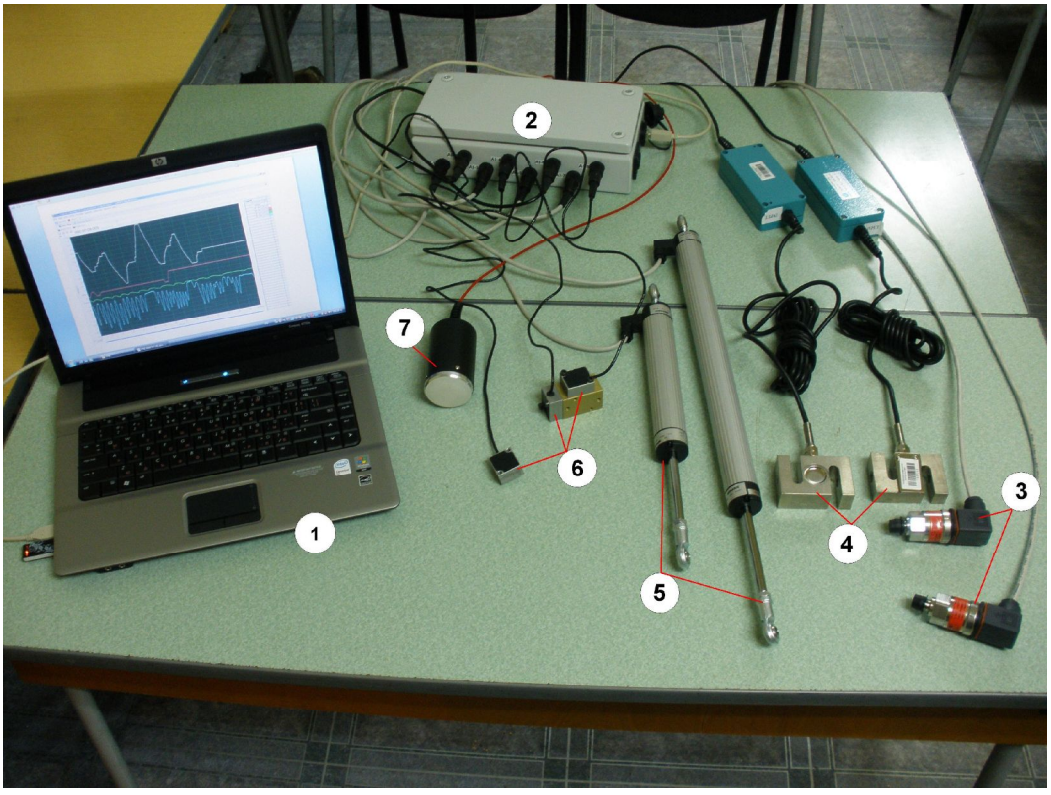

Fig.2. A general view of mobile testing system components: 1 – mobile computer; 2 – NI DAQ USB-6009 placed in a safety box; 3 – pressure sensors; 4 – force sensors; 5 – displacement sensors; 6 – acceleration sensors; 7 – speed sensor

This testing system can be used in different configurations depend on needs of experiments. In any case they can use only those sensors which are needed. The maximum is 8 analog and 2 digital sensors working simultaneously.
Typical applications of the mobile testing system are:

- estimation of braking or acceleration performance – speed, acceleration/deceleration, pressure in the braking system of the vehicle;
- estimation of vibrations, acting in different points and directions of the vehicle body;
- evaluation of the forces, acting in different points of vehicle body during motion process;
- studying of processes in hydraulic devices as agricultural tractor's hitch system or lifting system of the dumpers and fork-lifters.

For example, on Fig.3 and 4 are presented some results obtained by the mobile testing system. The object is a car during motion including 5 periods - acceleration up to 40 km/h; "snake" motion at constant speed (sequential left and right turn of the steering wheel); left turn in 90 degree; right turn in 90 degree and slow braking. During the motion both longitudinal and lateral accelerations are measured. The initial results obtained by the system are shown on Fig 3. After finishing of the experiment the data was transferred in program MS EXCEL, some simple calculations were done and final graphic is shown on Fig.4.

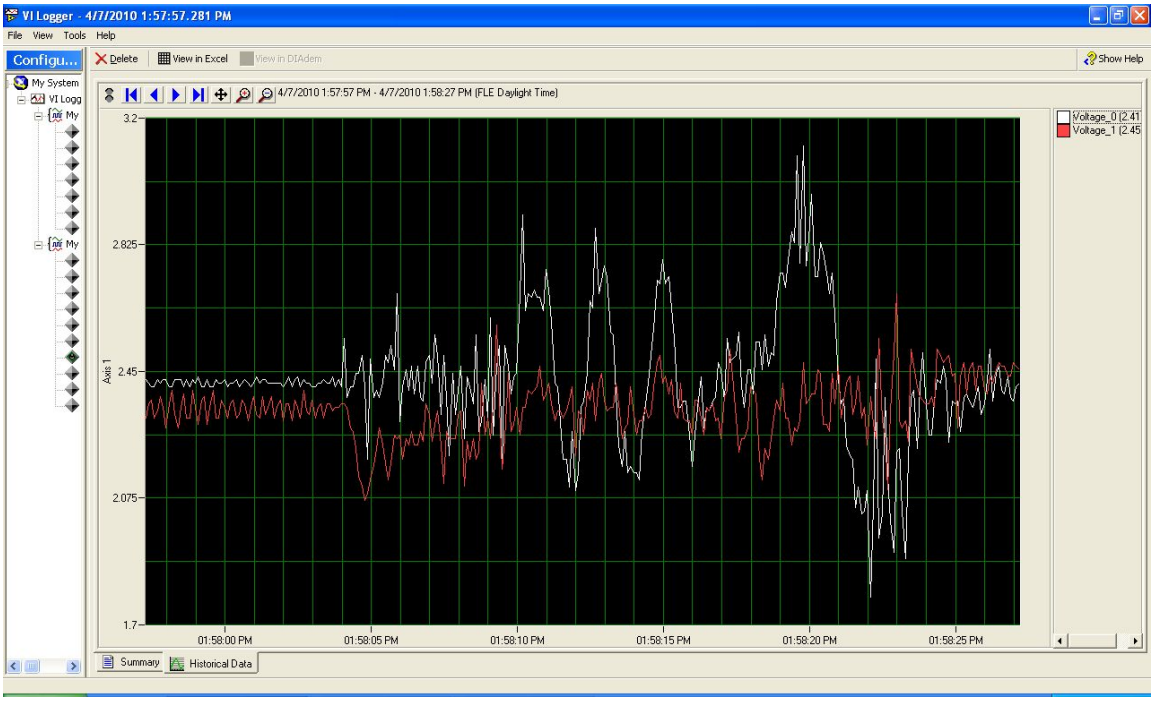

Fig.3. A view from the mobile computer desktop with initial data record after experiment

CONCLUSION

Our experience with using of the described mobile testing system gives us some reasons to declare following advantages:

- universal and simple use;
- mobility and fast compilation of the system for different types of experiments;

- easy visualization and estimation of results immediately after finishing of experiment;
- possibility to record data from more than one process simultaneously with high accuracy.

We recommend other researchers to use this kind of testing facilities for investigation of vehicle performance.

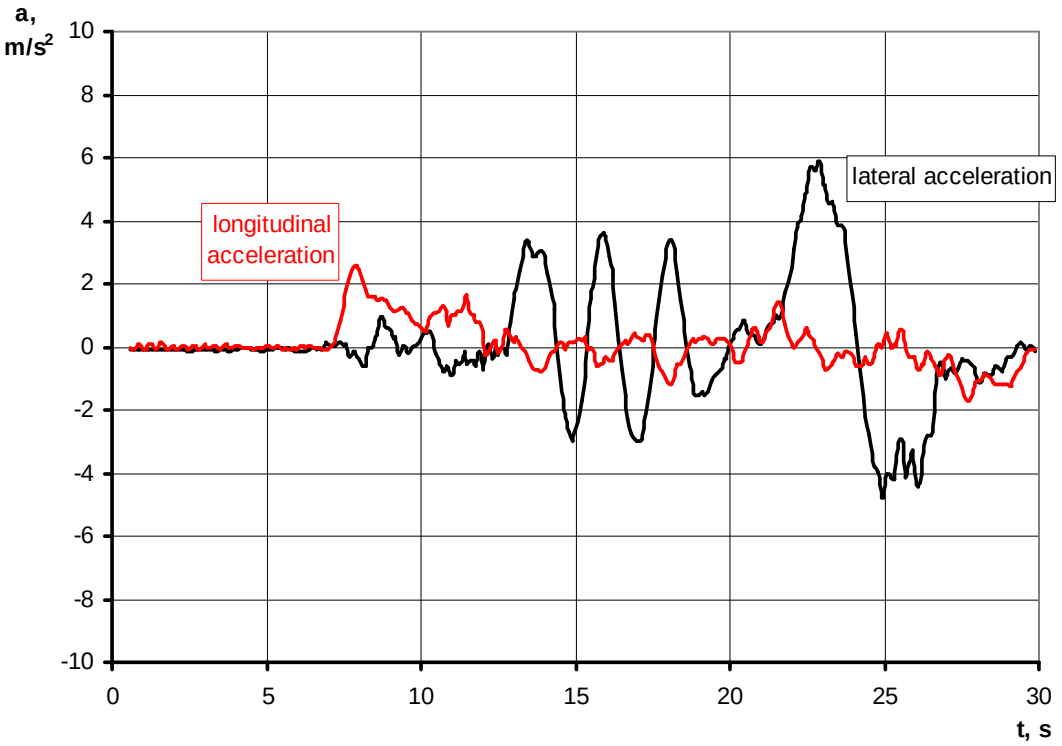

Fig.4. The obtained results after data processing in EXCEL

ACKNOWLEDGMENTS

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