UDK 629.054

THE USAGE OF BOARD COMPUTERS IN TRACTORS

J. Kaminski[1], PhD (Eng), G. Viselga[2], D.Sc. (Tech),
Ev. Ugnenko[3], D.Sc. (Tech), A. Jasinskas[4],
I. Tetsman[2], D.Sc. (Tech), O. Tymchenko[3], PhD (Tech)
[1] Warsaw University of Life Sciences (Warsaw)
[2] Vilnius Gediminas Technical University (Vilnius)
[3]Ukrainian State University of Railway Transport (Kharkiv)
[4] Vytautas Magnus University (Kaunas)

Since 1989 in Polish market there have been offered modern tractors, produced by Western companies, equipped with electronic steering and control systems [1, 2]. These systems include microprocessors for particular tractor unit service or board computer (microprocessor, microcomputer) for steering and control of several tractor units. In Polish agriculture only small percentage of tractors is equipped with such systems.

According to the Institute of Technology and Life Sciences, Mazovian Research Centre in Kiudzienko forecast - in the coming years the sale of such tractors in Polish market will be growing, mainly because of the increase of economic and ecological requirements and work quality, comfort of driving and service [3]. It is forcing the technical progress improving tractor designs and adjusting them to new requirements. More and more effective control systems are introduced to improve agricultural tractor usage. Transmission of signals between them (communication) enables realization of complex agro technical operations with quality (precision, accuracy) impossible to be reached by traditional (mechanical) driving systems of tractors and agricultural machinery.

Introduction of numerical techniques, allowing transmission of large number of information with significantly reduced number of cables was especially important from the point of view of application of electronics in tractors.

The objective of investigations was a trial of assessment of board computer usage possibility in tractors. The analysis was based on tractors produced by Case, Deutz, Fahr, Fendt, New Holland, John Deere, Massey Ferguson, Lamborghini, Valmet, Renault companies, sold in the largest quantities in the Polish market.

In tractors the systems of engine, gearbox, hydraulic ram, rear-wheel steering etc. can be linked together by cables transmitting digital data [4]. Steering and control systems located in the machines aggregated with tractor can co-operate with board computer installed in tractor. Usage of electronic system controlling interactions of system including: driver, tractor, machine and soil gives huge possibilities of improvement of aggregate work results, among others by: efficiency increase, fuel consumption decrease. Electronic adjustment of machines requires the compatibility of tractor computer, machine processor, cables and couplings necessary for connection of computer with machine processor to be achieved. Those units have been already standardized, and that is why the tractor may be aggregated with

machines equipped with electronic systems produced by different manufacturers. There are growing possibilities of electronic steering of farm tractor functions in two new technical solutions: system of tractor positioning in the field and system of mutual telecommunication between tractor, machine and office [5]. Recently Companies have demonstrated new tractors with hydrostatic drive and automating steering system without cabs and drivers, but in practice, those systems are not offered in Polish market.

The companies existing in Polish market equip their tractors with computer systems for measurement, registration, monitoring and automatic control of working parameters. In Poland there have been already distributed systems of indicators informing of a tractor malfunction and what is the remedy, as well as diagnostic systems applied in repair shops, simple electronic control devices (e.g. electronic limiter of rotation number, limiter of TUZ-[three point suspension system] upper position), microprocessor systems for several parameters control in particular sets of tractor (e.g. lift, gear box or engine), complex systems for automatic control of tractor-agricultural machine aggregates with board computers usage with modular structure (with possibility of adding of modules and enlarging by that the range of control) together with steering elements (electric valves, sensors) installed in tractor units and interconnected by a signal transmission bus.

On basis of above analysis units (sections) with electronic steering were chosen as having a possibility of wider use in tractors on Polish market at present and in near future as follows: 1 - engine (automatic control – installed equipment test, fuel dosage control); 2 - gear box (change, programming, damage diagnosis); 3 - lever (control, damage diagnosis); 4 - live axle (differential mechanism locking, in/off 4x4 drive, control system for locking + 4x4 drive, electronic control of front axle suspension); 5 - power take off (in/off, revolution adjustment, damage diagnosis); 6 - radar (measurement of real driving speed); 7 - planning (programming of unit functions, working parameters, advising).

[1] Kamicski J. R. Wyposaïenie ci№gnikyw w komputery pokiadowe. *Technika Rolnicza*. 2001. no 5/2001. P. 26-27.
[2] Kamicski J. R. Komputery pokiadowe w maszynach rolniczych. *Przegl№d Techniki Rolniczej i Leњnej*. 2002. no 7/2002. P. 2-6.
[3] Kamicski J. R. Ocena ekonomiczno-praktyczna stosowania i wykorzystania komputeryw pokiadowych w ci№gnikach rolniczych. *Problems of construction and exploitation of machinery and agricultural equipment:* Proceeding of X International symposium of prof. Czesiaw Kanafojski, 18-19 September 2006. Warsaw : Polytechnic, 2006. P. 91-94.
[4] Jaklicski L. Mechanika ukiadu pojazd – teren w teorii i badaniach. Warsaw : Polytechnic, 2006. 171 p.
[5] Skrobacki A., Ekielski A. Pojazdy i ci№gniki rolnicze. Warsaw : Wieњ Jutra, 2006. 248 p.