TRENDS IN AGRICULTURAL TRACTOR CAB SUSPENSION

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Operators of agricultural machinery are exposed to low and high frequency vibrations which have a complex effect on the whole body. When studying the effects of vibration on the operator-driver, it should be noted that the internal source of vibration (usually high frequency) is the operation of the power units and the external source is the movement along the complex micro-profile of the road surface and/or the action of the units. The human body has a complex mechanical system made up of many linear and non-linear components. The degree of harmful effect of vibrations on the human body depends on the frequency, duration and direction of action, as well as on the individual characteristics of the person. On the basis of the above, it should be noted that the way to reduce the impact of vibrations on the body of the operator-driver of a wheeled tractor is a priority area of scientific research, especially taking into account the increase in the energy saturation of tractors, the increase in the speed of technological and transport operations, the variety of machines and tools that are aggregated by a tractor.

Tractor operators are exposed to forces in three planes - up and down, side to side, and forwards and backwards. Cab suspension designers try to limit these movements to minimise the impact on the human body. In the automotive world, these movements would be reduced to zero. But an operator who has no sensory information about how his tractor is performing will be prone to overconfidence. So some movement in the cab is necessary. Some cab designers have got this wrong in the past and tractor operators have complained of motion sickness. In addition, tractor cabs are designed to protect the operator and it is important that suspension systems do not compromise this important aspect of safety.

There are basically three ways to control the movement required to damp the forces acting on the cabin - spring, pneumatic and hydraulic (via a gas accumulator). An example of a hydraulic cab suspension system is the HCS option from John Deere. As with most systems, only the rear of the cab has suspension units - the front is connected to the chassis via ball bearings at each corner, allowing for a small amount of lateral and longitudinal movement. The Claas Arion cab has suspension springs and shock absorbers in all four corners of the cab, not just the rear two. This is designed to reduce not only vertical movement, but also longitudinal movement. Valtra has developed a semi-active cab suspension system - AutoComfort, which automatically adjusts to different driving conditions. AutoComfort consists of electronically controlled shock absorbers, a position sensor and a control unit connected to the tractor via the CAN bus, as well as air springs to maintain a constant ride height regardless of load. In response to motion data from the position sensor and information on driving conditions from the CAN bus, the system is able to adjust the damping rate every two milliseconds. The Fendt VisioPlus cab also has semi-active cab suspension, which works on a similar principle to AutoComfort.