

## **HYBRID TRANSMISSION DESIGN CONCEPT FOR A WHEELED TRACTOR**

**Kozhushko A., Danylenko V., Dzhyhirei D.**

*National Technical University «Kharkiv Polytechnic Institute», Kharkiv*

The constant struggle to reduce the dependence of wheeled tractors on fossil fuels and the development of electric drive technologies make it possible to introduce hybrid technologies into the power units of transmissions of both agricultural and specialised (e.g. airfield) vehicles.

Speaking of the hybridisation of means, there are several basic structural concepts: serial, parallel and serial-parallel (mixed). Special attention should be paid to the parallel and series-parallel concepts of the structure of the hybrid transmission, because with such concepts the connection between the wheels and the combustion engine is not lost and the ability to operate in electric vehicle mode is maintained.

Today, advanced tractor technology companies are trying to implement hybrid technologies in the construction of modern, highly efficient tractors. Steyr presented the innovative Hybrid Drivetrain Concept, which is based on the concept of a diesel-electric hybrid. The focus is on the benefits of electric drive systems, which could provide high power to the tractor, thereby reducing fuel consumption. This concept is much more efficient in maintaining a stable maximum speed when driving uphill, thanks to the use of supercapacitor technology, which makes it possible to increase the effective power of the tractor while increasing driving resistance. This increases the power of the tractor and at the same time increases the resistance to movement, ensuring an increase in the intensity of acceleration and maintaining a stable high-speed movement when carrying out traction work with peak loads in conditions of high traction.

Well-known tractor manufacturers are using the proven technology of hydraulic-mechanical transmissions to build hybrid transmissions, where the hydraulic transmission is replaced by an electric drive. These companies include ZF Friedrichshafen AG and John Deere. The electric generator directly drives the electric motor, from which the converted current (from DC to AC) enters the gearbox. The torque is then transmitted from the electric motor to the planetary gear train, where the mechanical and electric power branches are combined. Electrical energy is also transmitted externally to accompanying machines. The power transmitted externally is not additional, but a part distributed externally and to the drive of the tractor transmission. It is known that approximately 80% of the power produced by the tractor's combustion engine is distributed to the transmission and up to 20% to auxiliary equipment connected to an external socket. When the external power is switched off, 100% of the power is sent to the tractor transmission. It is worth noting that the drives on the units do not receive constant power from an external socket, but are switched on automatically when the sensors detect the tractor wheels slipping. It is also switched on when the wheeled tractor moves uphill. This technology allows you to reduce the ballast on the tractor, which usually means an increase in traction, which also has an effect on reducing soil compaction and fuel consumption.