



by **Hermann Beck**,
Vice President, Construction
Machinery Systems, ZF

Increasing functionality by electronically networked systems

On the occasion of the 100th anniversary of SAE, ZF would like to cast a glance on the status and future opportunities of electronic systems. It has been many years now since they have been in use, and electronically controlled units have contributed to the improved operating behavior of off-highway machines. There is no end to this development in sight because further challenges have emerged with regard to added functionality, simplification of operation, and efficient fuel management.

The proposed solution from ZF is electronic system networking. The basic idea is to optimize not only individual units, but to optimize the unit in the system's network, and, thereby, to create new functionalities at a higher integration level. ZF's motto, "From the Unit to the System," will gain increased importance as equipment functionalities get more sophisticated in the near future and enable new riding and operating functions. The ultimate goal is to optimize operation, making it easier and more efficient.

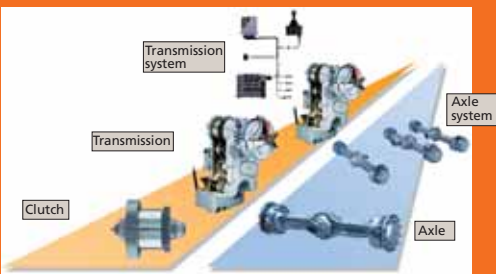
In the field of technological challenges, it is not only about developing advanced new functions, but, moreover, about mastering a high level of complexity. This aspect applies to both networking of the hardware with the corresponding bus systems and development of a clear, unique, and modular structure of functions. It is therefore necessary to depict the hierarchical levels of the system with the actuators, controllers, and nominal values to understand where possible

target conflicts may emerge. These will then be solved by inserting an additional coordinating layer. The modular structure enables flexible adaptation of various vehicle variants.

The wheel loader's power management is a typical example for the implementation of networked electronic functions. In this particular case, it is all about distributing the power generated by the diesel engine in an optimum way between the drive system and the hydraulic system in charge of implementing operation. Moreover, the drive system's functions must be presented as an overall task. Beyond mere transmission-control functions, engine, brake, and axle are now integrated in the scope of management functions. Tasks that were assigned to the driver in the past are now taken over by the electronics. Thus, the driver is able to focus on the prime requirements of driving, steering, and working as the pilot.

The prerequisite for such progress is competent electronics development that masters the well-known disciplines of hardware and software development. In addition, it must be able to provide excellent integration competencies and control the corresponding development processes. Bundling of knowledge by means of corporate ZF central electronics departments guarantees optimum know-how exchange and creates the necessary synergies with the developers of other vehicle types. Thus, ZF is equipped to confidently face electronic challenges of the future. **OHE**

Vehicle



From the unit to the system