Introduction: Hydraulic components in vehicle power transmission systems

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Hydraulic components are frequently used in many types of vehicle power transmission systems.

As an example a hydrostatic transmission is widely used in tractors, construction and mining machinery, road and forest machines, locomotives, trucks and other heavy-duty vehicles. A hydrostatic transmission carries torque over certain distance without a mechanical effort. Such arrangement is being used increasingly in road vehicles due to high power density and improved efficiency.

A hydrodynamic torque converter is a necessary component of automatic transmission. Major advantage of the hydrodynamic torque converter is an ample damping capacity of various disturbances introduced by either the hydrodynamic torque converter or other downstream components. In addition, the hydrodynamic torque converter provides torque amplification during the vehicle driving phase.

Due to ecological aspects and better efficiency emphasis on proper coupling of vehicle hydraulic transmissions with internal combustion engine is applied.

Regardless of this some vehicles are steered hydraulically. Force/torque amplification equipment installed in domestic and larger vehicles are called power steering systems. Obviously the main purpose of such a system is to reduce drivers' steering manoeuvring efforts. Good power steering reduces the driver's fatigue and enables the vehicle to be rapidly manoeuvred out of difficulties. Electro-hydraulic and direct electrical power steering are developing trends.

The demand for better performance and higher comfort of vehicles drives the search for new solutions.

One of them is using new kinds of working fluids such as water and smart fluids. Application of these fluids ignited the search for new construction and development of modern vehicles. Water is an ecological working fluid. Power from water can be used to power all a vehicle's circuits such as steering, propulsion, reel drives, etc. Smart fluids react upon applied electromagnetic or electric field changes affecting corresponding viscosity. Effects of viscosity changes within rheological working fluid can be utilised for transmission system control purposes.

Another new solution is the application of Mechatronics as a new design philosophy. Integration of mechanical, electronic and computer components into mechanical units of vehicle improves their reliability, expands their capabilities and working life span.

Current hydraulic design tools are significantly improved due to advanced design methodologies. Extensive experimental flow data were required to develop and verify computational results. Based on this research, computational fluid

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dynamics (CFD) analysis is developed and applied. Laser velocity metering is used to map out 3-D average and periodic velocities in hydrodynamic torque converter impellers.

Application of hydraulic elements in vehicle power transmission systems brings a large number of advantages in new vehicle designs, and it is a sign of technical modernity.