Kinetic energy recovery system (kers) for vehicles

During deceleration, traditional brake of a vehicle transforms the kinetic energy into thermal energy. This is due to the fact that when brakes are applied the friction between the brakes shoe or the calliper as used in modern disc brakes and the wheel not only restricts the motion of the wheel but at the same time a lot of heat energy is generated due to this braking action. Unfortunately there is a huge waste of the generated energy in the form of heat as a large amount of it dissipates into the air.

Hence in order to make use of this heat energy, the idea of kinetic energy recovery for vehicles has been explored. Although this system is in use in motorsport and other few selected high performance fields, method like using regenerative brake to generate electric energy is already used in hybrid cars. However, transforming the mechanical energy into an electrical form has a limited efficiency and is not an easy task, but requires complex mechanical systems.

Working

By using acceleration sensor controlled gear box, acceleration and deceleration could be performed by the transfer of mechanical energy between the vehicle and its energy storing unit, thus reduce energy consumption. The design contains three basic parts: a control unit, an infinitely continuously variable transmission gearbox and an energy storing unit. There are two possible solutions for the energy storing unit: a big torsion spring or a flywheel. Both the two solutions work with the system.

THE SPRING SYSTEM:

During deceleration of a train, instead of using break, the wheels are connected to a torsion spring with the help of the gearbox. This in turn transforms the kinetic energy into the spring's potential energy. However, the spring does not provide constant torque, according to Hooke's law. In order to perform stable deceleration, the sensor controlled gearbox changes the gear ratio through a continuously variable transmission mechanism. The desired deceleration rate is determined by the driver. The acceleration sensor senses the actual deceleration rate and gives accurate feedback. Through a feedback control loop, the gear ratio is adjusted continuously and deceleration rate can be maintained at the desired level. In cases when spring has its maximum load, normal braking is activated. When the train stops, the spring will be held. When the train starts again, instead of using its engine or motor, the gear box connects the spring to the wheels but in an opposite way to drive the train. The acceleration torque provided by the spring decreases with the release of the spring. Again, through sensor feedback control loop, the transmission gear ratio is adjusted continuously to maintain the acceleration rate. Once the spring is fully released, the motor is again activated.

THE FLYWHEEL SYSTEM:

System with a flywheel works in a similar way. Energy is stored into the wheel by increasing of the spinning speed. In order to provide constant torque transmission gear ratio need to change. With the implementation of acceleration feedback control, the braking output could be adjusted through changing the transmission gear ratio. The kinetic energy could be completely (except the loss on bearings and transmission gears) stored during braking and given back during acceleration. This system could work with both combustion engines and electric motors. Thus the limited energy recourses could be saved.

KERS is essentially an energy-storing flywheel attached to an efficient Continuously Variable Transmission. Under braking, energy that would usually be expended as heat is instead used to accelerate the flywheel. When needed the power can then be used to augment that of the internal combustion engine What makes the system green isn’t the added performance, but the use of energy that has traditionally been wasted.

Working and Specification

Kinetic Energy Recovery System (KERS) is the word which is being associated with Formula 1 cars and has been in the Headlines for quite a while. All 2010 Formula 1 cars feature KERS as an integral part after it was made mandatory by FIA to be installed and is currently being manufactured by Flybrid Systems.

What is KERS?

KERS as the name suggests is an energy recovery system also known as regenerative system but importantly the KERS is quite advanced than the conventional energy recovery systems. The mechanism functions in a way that it reduces the speed of the vehicle by converting some of its kinetic energy and/or potential energy(in case of elevations) and storing it into a useful form of energy instead of dissipating it as heat as seen in conventional dynamic braking system.

Technically KERS can be defined as an Electric generation, storage, and propulsion system generating electricity during slow down or braking, storing it in batteries, and later assisting the gasoline engine by boosting acceleration with the help of electric drive motors.

The device will be installed in F1 cars to save energy utilized while braking, store it and further use it when required. KERS is of two types one mechanical and the other electrical.

What does KERS contains?

The system basically consists of a CVT(Continuously Variable Transmission) unit , a clutch, an epicyclic gearbox and a flywheel (The mechanical type contains a FLYWHEEL to retain power while the Electrical type contains an electric motor twinned with a BATTERY or CAPACITOR or FLYWHEEL)

Working of Kinetic Energy Recovery System

The engine drives the KERS system and it is coupled with the drivetrain. The drive comes into the CVT unit which effectively changes the gear ratio in accordance with the flywheel and rotates the flywheel. The control pistons seamlessly change the gear ratios between the input and the flywheel moving at a much faster rate than the actual drive (5: 1 ratio at 64, 000 rpm). The amount of energy stored or released depends upon the torque transfer taking place within the CVT unit, which is controlled by the position of the levers.

Conclusion

KERS is a particularly appealing proposition for road-going vehicles because of its lack of weight and relative simplicity over the energy storing systems in current hybrids like the Toyota Prius. KERS doesn't need batteries and is therefore free of their weight and the environmental impact that comes from creating and disposing of them. In city riding KERS would have a significant impact on emissions, providing emissions-free power for initial acceleration away from stoplights and similar. In performance applications the system could provide on-demand extra power for overtaking or accelerating hard out of corners, using power that would've normally been wasted as brake heat on corner entry. More power using less fuel can be easily achieved.