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Energy Recovery System Optimisation In Automotives
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Background of Research
To limit the associated increase in fuel consumption and exhaust emissions, smart strategies for the generation, storage/retrieval, distribution, and consumption of electric power will be used in automotives. Research on energy recovery systems for modern vehicles complement and supply the vehicular electric power system to reduce the fuel use and emissions, by generating and storing electrical energy only at the most suitable moments and subsystems.

Aim of Research
The aim of this research is to develop and optimise energy recovery systems in automotives. Especially, the focus will be on systems to recovery energy from braking and vibration processes in which the energy density is high.

Energy Recovery Systems
1. Regenerative braking system

A regenerative braking system is to recover energy as the vehicle slow down or stop by depressing the brake pedal and convert vehicular kinetic energy into electricity and to recharge the vehicle’s batteries.

2. Exhaust energy recovery system
The exhaust recovery is recycled heat from vehicular exhaust system.

3. Suspension energy recovery system
Energy recovery suspension can achieve damping function and energy recovery by changing the damper vibration produced by road roughness into electrical energy.

Future Work
• Design new mechanisms in both braking and suspension systems for maximising energy recovery.
• Improve the energy density and efficiency by taking the harvesting electrical circuit and the harvester output resistance into account.
• Combine with vibration energy harvesting techniques, electromagnetic to improve the energy recovery test rig facility.

Figure 1. The basic principle of regenerative braking
Figure 2. The diagram of electromagnetic active suspension.
Figure 3. Block diagram of control for an electromagnetic suspension.
Figure 4. (a) Diagram of the linear electromagnetic shock absorber and (b) the cross section of the magnet assembly.

Regenerative Shock Absorber

Controller
Battery or voltage detector
Sensor circuit
Electric converter

Electromagnetic actuator
Spring and damper

Electromagnetic active suspension
Control unit

Figure 3. Block diagram of control for an electromagnetic suspension