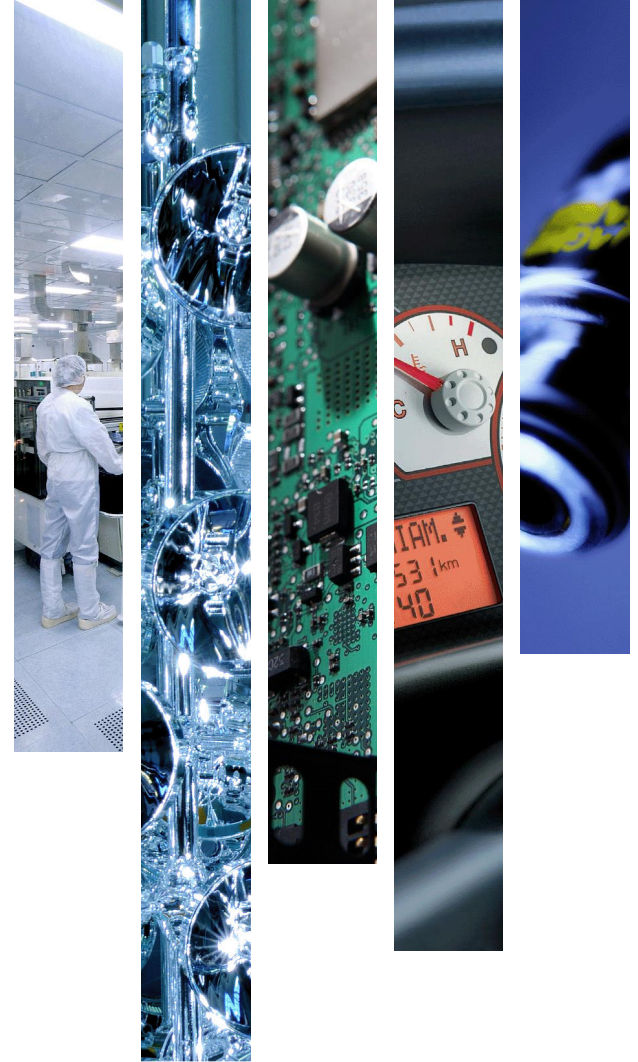




Energy harvesting and management in electric vehicles

Andrea Nepote



Energy harvesting possibilities



- **Regenerative braking**

Already working on BEV and HEV:

- Optimization
- Coexistence with other energy harvesters

- **Photovoltaic**

Some car applications in the market:

- Technology improvements (automotive oriented)
- Maximum Power Point Tracking application oriented

- **Vibration energy**

Harvesting from shock absorbers

- **Thermoelectric**

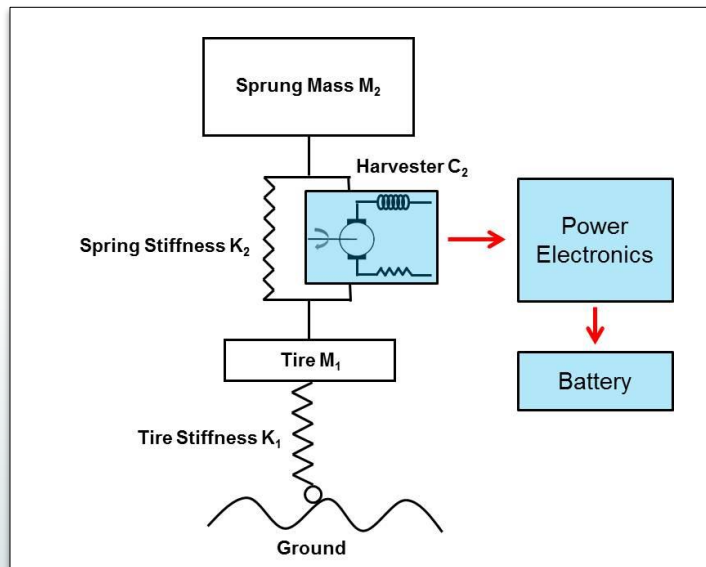
Research on going for ICE (and HEV):

- Any possible use on BEV?

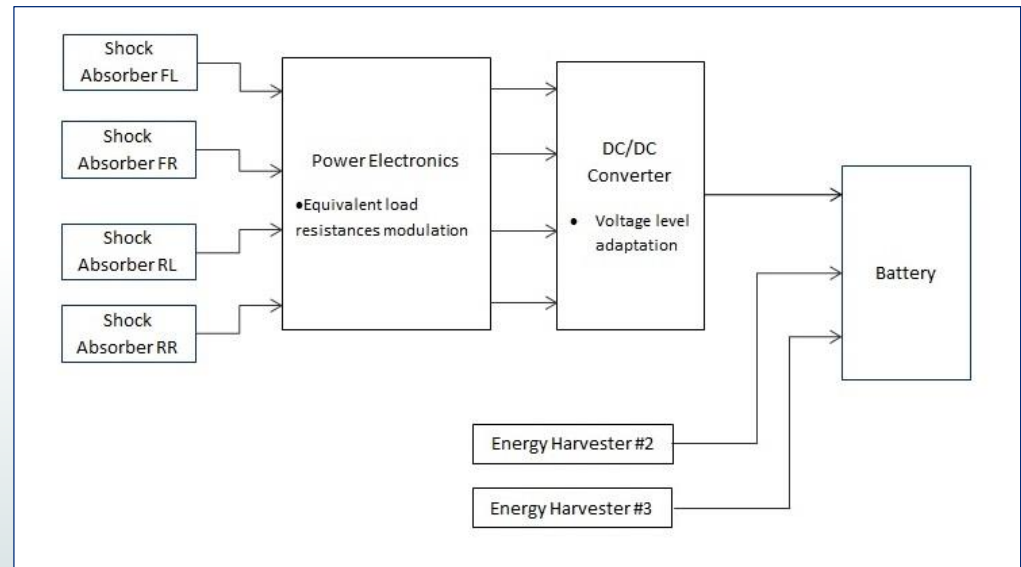
- **Any other sources?**

Energy harvesting from suspensions vibrations

The shock absorber becomes a harvester

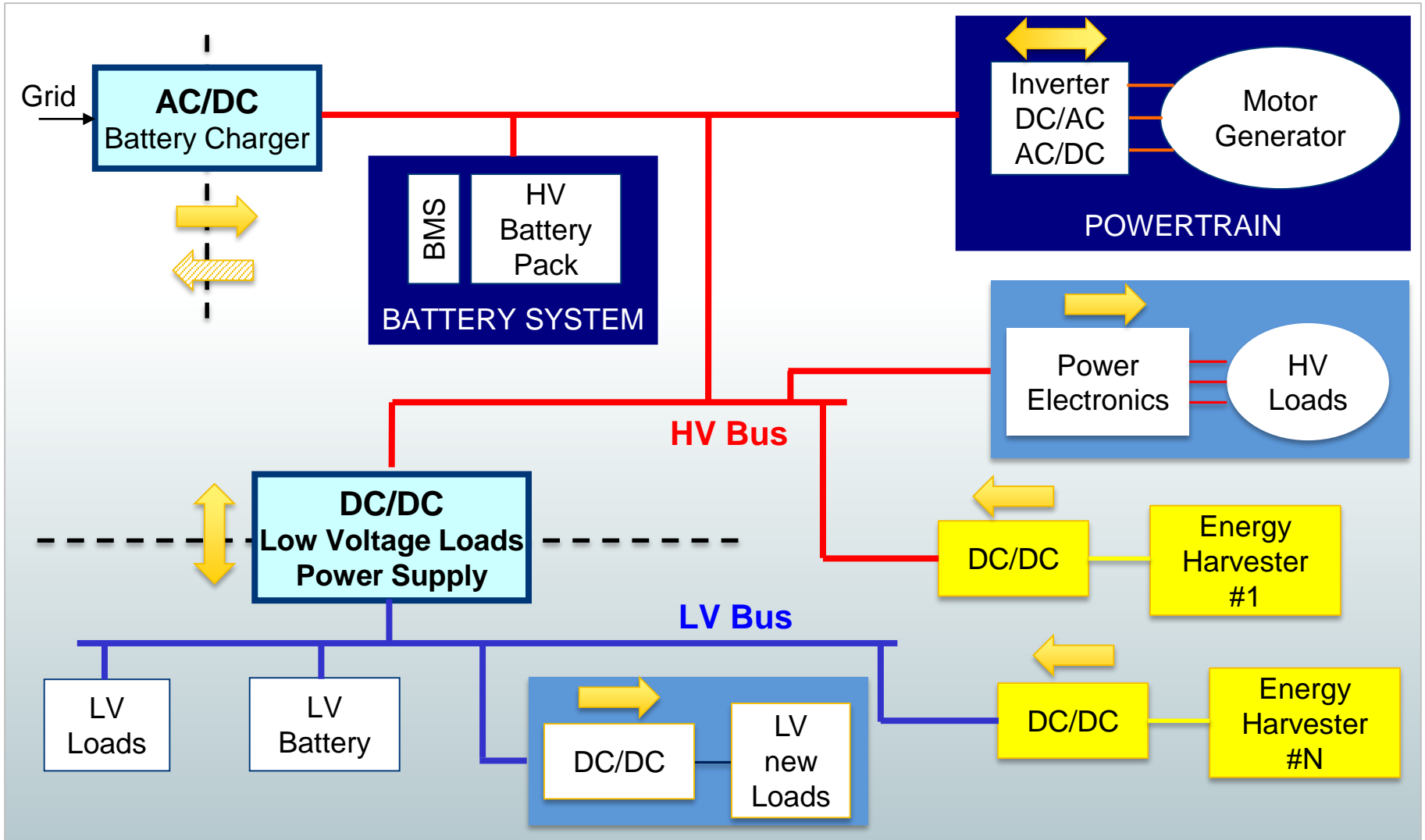


Integration of the harvester into the vehicle electric grid



- Traditional shock absorbers dissipate the kinetic energy of vehicles suspensions into heat. Such energy is completely lost.
- Regenerative shock absorbers convert part of the kinetic energy of the suspensions into electric energy, which is used to charge the battery. In this way it is possible to extend the range of electric vehicles.

Energy Management in Electric Vehicles



- High efficiency energy harvesting functions related to the **recuperation of the kinetic energy** of vehicles suspensions by means of **regenerative shock absorbers**.
- **Investigation** on other possible sources of harvestable energy.
- **Electric Power Networks Architecture** considering voltage levels (HV, LV), generation (brake energy recuperation, harvesting from different sources, battery charger), storage (batteries, Ultracapacitors), energy conversion (DC-DC converters), load actuation.
- Energy Management **Electronic Control Unit(s)** (Supervisor, intelligence distribution, communication aspects).
- **DC-DC converter architectures**, topologies and control.
- **Strategies for generation, storage and utilization** for overall efficiency and vehicle range optimization.

Thank you for your attention