

# Hybrid Energy Storages in Electric Vehicles

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## Abstract

In the whole world, in recent years there has been a rapid increase in popularity of electric and hybrid vehicles. This is mainly due because of constantly rising fuel prices and growing environmental awareness of society. The popularity of electric vehicles also results from the fact that their drive systems are characterized by a much more higher efficiency than in vehicles with combustion engine. However, they require the use of electric energy storages, which parameters are still not satisfactory (power density vs energy density). For this reason, more and more they are becoming popular hybrid energy storage, having diverse electric parameters that enable dynamic adaptation of a storage to the demands of the electric motor, especially in the dynamic acceleration and regenerative braking. This paper describes the issue of analysis of the vehicles energy consumption and selection of optimal hybrid energy storage, as well as optimization of the energy flow in electric vehicles. It describes in detail the mathematical model of a car and an analyse method of the vehicle energy consumption. The computational algorithm takes into account the driving characteristics of the real vehicle moving in a city area, registered with use of designed and a self-built drive recorder. On this basis, the optimization was performed, which was made using an application elaborated in MS Visual C#. The correctness of the analysis of the electric vehicle energy consumption and a mathematical model was verified by using simulation prepared in MatLab environment. In the conclusions, the influence of a selection of energy storage and control algorithm for energy saving was commented.

## References

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