УДК 629.33-025.26

T.Rudnytska
M.Telinskyi

THE BENEFITS OF HYBRIDS AS A HIGH-EFFICIENCY AUTOMOTIVE SYSTEM

Vinnytsia National Technical University

Анотація: *У статті розглянуто принципи роботи та переваги гібридних автомобілів як проміжної ланки між ДВЗ та електромобілями. Описано основні типи гібридних силових установок та їх вплив на екологію.*
Ключові слова: *Гібридний автомобіль, силова установка, паливна ефективність, рекуперативне гальмування, екологічність.*
Abstract: *The article considers the operating principles and benefits of hybrid electric vehicles (HEVs) as a bridge between internal combustion engines and electric cars. The main types of hybrid powertrains and their environmental impact are described.*
Keywords: *Hybrid vehicle, powertrain, fuel efficiency, regenerative braking, eco-friendliness.*

Introduction

The modern automotive industry is undergoing a significant transformation aimed at reducing carbon emissions and increasing fuel efficiency. Hybrid electric vehicles (HEVs) combine a conventional internal combustion engine (ICE) with an electric propulsion system. This synergy allows for better performance and lower fuel consumption compared to traditional vehicles.

Statement of basic materials

Hybrid technology is one of the most popular automotive power systems in the world. It was created by various engineers throughout history, but the modern version was significantly advanced by Toyota and released in 1997 with the Prius. It runs on different platforms such as Hatchbacks, SUVs, Sedans, and even high-performance race cars. With its efficient powertrain, it is easy for daily commuters to save fuel. At the same time, it's powerful for advanced performance applications. Engineers use hybrid systems to create fuel-efficient engines, regenerative braking systems, performance boosters etc. To manage hybrid systems, manufacturers use different Electronic Control Units (ECUs). For example, the most powerful tool is the Hybrid Control Module. It allows to monitor battery health, manage energy flow, optimize fuel consumption etc. The second is the Inverter/Converter assembly.

Hybrid technology can do many helpful things such as fuel consumption reduction, lowering CO2 emissions, providing instant torque. Also, hybrid systems work on different vehicle types like passenger cars, heavy-duty trucks, buses, and Formula 1 cars. It is used for urban commuting, long-distance travel, logistics etc. Hybrid systems have easy to understand operational modes like EV-only and Power-assist. With a hybrid car you can do the following tasks:

- reduce fuel costs;
- recover energy through braking;
- drive silently in electric mode;
- automate engine start-stop;
- work with dual power sources;
- change driving modes (Eco, Sport, EV);
- monitor energy flow in real-time etc.

The most famous hybrid system architectures are Series, Parallel, Series-Parallel, and Plug-in. Series-Parallel hybrids are perfected by Toyota. This system is available in two main configurations:

- Standard Hybrid (self-charging);

– Plug-in Hybrid (external charging).

Mild Hybrid (MHEV) is designed for users with a focus on simplicity and it has the following features:

– easy to integrate into gas cars;

– no-hassle battery charging;

– simple 48V electrical system;

– step through engine-off coasting;

– faithful representation of traditional driving feel;

– highlights energy efficiency etc;

– beginner friendly maintenance schedule.

Plug-in Hybrid (PHEV) – the advanced hybrid environment. It's flexible and powerful. PHEV uses through a standard wall outlet or specialized charging stations. High-performance hybrid systems with ERS (Energy Recovery System) provide MGU-K (Kinetic), MGU-H (Heat), and sophisticated battery management. You can run high speeds, use regenerative energy, and configure settings for a customized performance. Install the hybrid battery, add the electric motor, and select a power mode to get started..

Conclusion

To conclude, hybrid technology is one of the most powerful tools for drivers both daily commuters and performance enthusiasts. It is used in various fields from urban transportation and family travel to heavy logistics and motorsport. It has powerful and different mechanical components and software allowing professional engineers to build complex, efficient vehicles. There are many hybrid configurations that support modern mobility such as Series, Parallel, and Plug-in systems that help to facilitate the work of reducing global emissions.

REFERENCES

1. https://www.toyota.com/electrified-vehicles/
2. https://www.energy.gov/eere/vehicles/hybrid-electric-vehicles
3. https://www.honda.com/electrification/hybrid
4. https://www.f1.com/inside-f1/understanding-the-f1-hybrid-power-unit/
5. https://www.sae.org/topics/hybrid-vehicles

Рудницька Тетяна Григорівна – старший викладач кафедри іноземних мов, Вінницький національний технічний університет, e-mail: rudnytska@vntu.edu.ua

Телінський Максим Тарасович **–** студент групи 1АТ-24б, Факультету Машинобудування та Транспорту, Вінницький національний технічний університет, м. Вінниця, e-mail: mtelinskij@gmail.com

Rudnytska Tetiana Hryhorivna – an Assistant Professor of Foreign Languages Department, Vinnytsia National Technical University, e-mail: rudnytska@vntu.edu.ua

Telinskyi Maksym Tarasovych – student of group 1AT-24b, Faculty of Mechanical Engineering and Transport, Vinnytsia National Technical University, Vinnytsia, e-mail: mtelinskij@gmail.com