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Hyper Car

Krushna Kachhawal[1], Akash Vadatkar[2], Prof. V.S.Patil[3], Krishna Khadse[4]

Department of Mechanical Engineering, STC, SPRT, Khamgaon[1,2,3,4]

Abstract: The Hyper car design concept combines an ultra light, ultra-aerodynamic auto body with a hybrid-electric drive system. This combination would allow dramatic improvements in fuel efficiency and emissions. Computer models predict that near-term hyper cars of the same size and performance of today's typical 4-5 passenger family cars would get three times better fuel economy. In the long run, this factor could surpass five, even approaching ten. Emissions, depending on the power plant, or APU, would drop between one and three orders of magnitude, enough to qualify as an "Equivalent" Zero Emission Vehicles (EZEV).

In all, hyper cars' fuel efficiency, low emissions, recyclability, and durability should make them very friendly to the environment. However, environmental friendliness is currently not a feature that consumers particularly look for when purchasing a car. Consumers value affordability, safety, durability, performance, and convenience much more. If a vehicle can not meet these consumer desires as well as be profitable for its manufacturer, it will not succeed in the marketplace. Simply put, market acceptance is paramount. As a result, hyper cars principally strive to be more attractive than conventional cars to consumers, on consumers' own terms, and just as profitable to make.

Keywords: EZEV, Hyper system, hybrid system, components, applications.

I. INTRODUCTION

Oil wells, pipelines, refineries, gas stations, coal mines, generating plants, transmission wires, and related technologies together make up the planet's largest and most expensive technological system. Based primarily on oil, coal, and natural gas, energy services structure everyday life both directly and by enabling computing, air-conditioning, telecommunications, and global transport. For nearly half a century, environmentalists and technological innovators have been urging reduced reliance on fossil fuels, but technological momentum remains dominant. Alternative energy advocates long have believed that renewable energy from sun, wind, and biomass could supply the planet's needs.

Electricity generated by wind turbines is now the largest renewable source. Wind power is expected to triple within a decade, partly because it is the least-expensive renewable source. Solar thermal energy for space heating, once considered the most promising alternative source, but it so far has proven too fussy and too expensive for widespread use.

The two configurations of hybrid electric vehicles are the series and the parallel configurations. In a series configuration, there is no power transferred mechanically between the gas engine and the wheels. In this type of configuration, power is converted from chemical, to mechanical, to electrical, and back to mechanical energy. The advantage of a series configuration is that since the engine never idles, there are fewer emissions, so it is better for the environment. The disadvantage of this configuration occurs on the highway since the power from engine is converted from mechanical to electrical and then back to mechanical energy again. The series configuration is less efficient than the parallel configuration because of the inefficiency in these energy conversions.

In the parallel configuration, there is a direct mechanical connection from both the electric power unit and the gas engine to the wheels. The batteries power the electric motor and the electric motor powers the wheels. The gas engine also powers the wheels. In a parallel system, there is also a possibility of a regenerative braking system — every time the car brakes, the batteries are charged. The advantage of a parallel configuration is that since both the electric motor and the engine help in powering the wheels, the car generally has more power than a series configuration. In addition, at highway speeds, this type of a configuration can afford higher fuel efficiency because there are fewer energy conversions than in a series configuration. The disadvantage of a parallel configuration is that it usually releases more emissions into the environment than a series vehicle.

II . HYPER SYSTEMS ANALYSIS

The rapid depletion of fossil fuel resources on a worldwide basis has necessitated an urgent search for alternative energy sources to cater to the present day demands. Alternative energy resources such as solar, wind, ocean thermal and tidal have attracted energy sectors to generate power on a large scale. However, solar and wind energy systems are being considered as promising power generating sources due to availability and the topological advantages in local

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power generation. It is prudent that neither standalone wind energy system nor solar system can provide a continuous supply of energy due to seasonal that combine solar and wind generating units with battery backups are implemented to satisfy the load demand.[1]

The hyper systems are dynamical systems with interacting continuous-time dynamics (modeled by differential equations) and discrete-event dynamics (modeled by automata). They are important in applications in CAD, real-time software, robotics and automation, aeronautics, air and ground transportation systems, process control, and have recently been at the center of intense research activity in the control theory, computer-aided verification, and artificial intelligence communities. In the past several years, methodologies have been developed to model hyper systems, to analyze their behavior, and to synthesize controllers that guarantee closed-loop safety and performance specifications. These advances have been complemented by computational tools for the automatic verification and simulation of hyper systems.

The process of adopting new technologies is very slow. The main problem for the installation of new facilities is the starting price. This raises the price of energy obtained in the first few years at the level higher then energy available on conventional methods. A large part of energy production from renewable sources is the result of ecological consciousness of the population, which in spite of initial economic cost install facilities for the production of "clean" energy. The European community has a strategy for doubling the use of renewable energy sources. The plan contains a series of measures to encourage private investment in facilities to convert renewable energy into usable energy (the most part into electricity). In addition, the state of the European Union (EU) have set another ambitious goal to increase the share of renewable energy sources 20% of overall energy consumption in the EU until 2020. year.

Fig. 1. Hyper Car

III WORKING

The internal combustion engine produce high amount of pollution and with less emission. On the other hand the electric drive has zero emission but the applications are limited. It reduces pollution in the cities as well as average. The hyper car use a smaller engine which size kept closer to the average power requirement rather than kept power a smaller engine is more efficient due the reason it can run at optimum capacity, as compare to bigger engine. A hyper car gets power from both a gasoline engine and an electric motor. The engine and motor can work together in different ways. In Some hyper there are times when only one of them operates. In hyper cars, the engine can automatically shut off when it is not needed—for example, at a red light or in stop-and-go traffic. This is one reason why hyper usually
Use less gasoline than traditional cars. Another reason is that since The electric motor does some of the work of moving the car; the gasoline engine is usually smaller than in traditional cars. The motor—as in electric cars—gets power from large batteries. Unlike ordinary electric cars, most of today's hyper don't need to be plugged in to get recharged. Instead, their batteries can be recharged. While the car is being used. The car may have a generator to make electricity. This generator is powered by the gasoline engine.

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In some hyper the electric motor it self works as a generator at times.

Design Types
There are two basic ways the engine and motor can work together. They are called parallel and series. In a parallel hyper, the engine and motor both supply power that drives the wheels. In a series hyper, the gasoline Engine is used to generate electricity; the electric motor drives the wheels. A hyper is a cross between two types of cars. It takes some features from gasoline cars. It also takes some from electric cars. This Lets it improve on some of the weak points of each type.
Hyper can go farther than electric cars. Their top speed tends to be higher. Unlike electric cars, they generally don't need to be plugged in for a recharge. A hyper car's electric motor gives it good power for going uphill or passing. Hyper tend to be quieter than traditional gasoline cars. Since a Hyper internal-combustion engine generally doesn't burn as much fuel; hyper use up less of the world's oil and cause less pollution. Saving on Gasoline.
There are several reasons why a hyper usually uses less gasoline than a similar car with a traditional engine. It doesn't have to use fuel for idling, since the engine can just shut off when the car is stopped. Also, since the electric motor helps power the car, the engine does not need to be as big and heavy as in a traditional car. Smaller gasoline engines tend to be more efficient than large ones, and they burn less fuel. More savings come if the electric motor can drive the car at low speeds all by it self. Gasoline engines are not very efficient at low speeds.
It's hard to say who made the first hyper. Having two different power sources is actually an old idea. The first important hyper that we Know of today was made around 1900by the famous Austrian car designer Ferdinand Porsche. The car had a gasoline engine, and there were electric motors in the wheel hubs. It was a series hyper. The engine ran a generator that made electricity .Other people also made hyper in the early 20th century. But the internal-combustion car is came very popular. It was powerful, and fuel was cheap and easy to get. Also, hyper cars cost more to make. For decades few people bothered to even experiment with them.

HOW HYPER CARS WORK

A. Parallel Type

Gasoline engine and electric motor work together to move the car forward

Fig. 2. Parallel Type

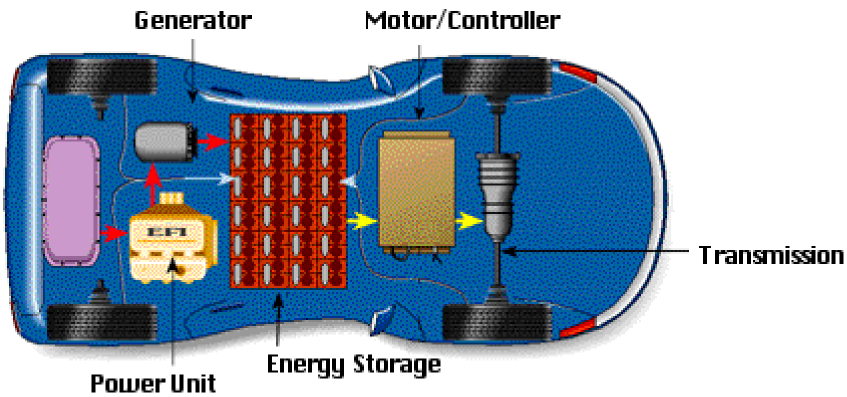

Fig. 3. Parallel Hybrid System

The Parallel Hybrid System:

With the parallel hybrid system, both the engine and the electric motor turn the transmission at the same time, and the transmission then turns the wheels. With a parallel hybrid, both the electric motor and the internal combustion engine provide propulsion power. Therefore drive comes from parallel sources.

Advantages

- ICE directly connected to wheels -> fewer power conversions
- Electric machine and gearboxes present -> ICE working pt. can be chosen freely

Disadvantages

- ICE & electrical machines must be mounted together -> no low floor

B. Series Type

Gasoline engine either directly powers an electric motor that powers the vehicle, or charges batteries that will power the battery.

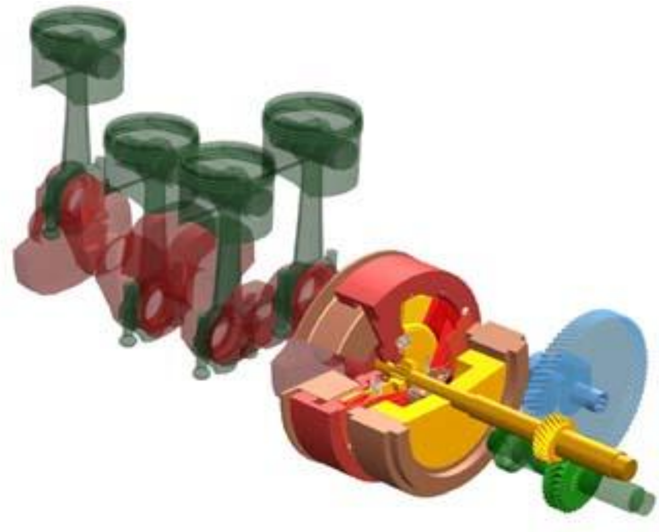

Fig. 4. Series Type

The Series Hybrid System:

With the series hybrid system, the internal combustion engine drives a generator, which can either charge the batteries or power an electric motor that drives the transmission. Thus, the gasoline engine never directly powers the vehicle. Because the engine drives a generator and the generator feeds the electric motor, which in turn drives the transmission, all of the components feed each other, therefore the system is said to be in series.

Advantages

- ICE running mostly at optimal speed and torque
- ICE can be turned off in zero emission zone
- Low floor possible
- Low fuel consumption
- High fuel efficiency

Disadvantages

- Many energy conversions -> energy loss
- More suitable for city driving

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C. *Series Parallel Hybrid System*

However, the latest trend is to combine both systems in what is called the Series Parallel Hybrid System. With the Series Parallel Hybrid System, it is possible to drive the wheels using the dual sources of power (electric motors and/or internal combustion engine), as well as to generate electricity while running on the electric motors. The system runs the car on power from the electric motors only, or by using both the internal combustion engine and the electric motors together, depending on the driving conditions. Since the generator is integrated into the system, the battery can be charged while the car is running.

The basic components of a typical Series Parallel System are:

1. Electric motor/s
2. Nickel Metal Hydride Battery
3. Internal combustion engine
4. Generator
5. Power split device
6. Power control unit (inverter/converter)
7. ECU

A. *Electric Motor:*

Synchronous A/C motors are used, which can efficiently produce strong torque at low speeds. They are also compact, light-weight and very efficient, resulting in smoother starting and acceleration. The motors are 3-phase A/C and utilise permanent rotor magnets positioned in the ideal V-figure configuration. Most require a high voltage supply, 250/300-volt and provide an output of 50 KW power with 400 Nm of torque. Most modern Hybrids propel the vehicle from standstill up to around 30 MPH by using the drive of the Electric motor alone.

B. *Battery:*

Most batteries are housed in the boot well area and are nickel metal hydride (Ni-MH). In addition to being light-weight and having a long service life, the high power output Ni-MH battery provides a high power to weight ratio. The battery voltage is normally around 200-volts; however on the very latest Toyota vehicles it's higher at 288-volts. These batteries, by the way, do not require recharging from an outside power source, nor do they require periodical replacement.
Furthermore, the control system maintains the battery charge at a constant level at all times by monitoring and computing the cumulative amount of discharge under acceleration, and recharging by regenerative braking or with surplus power under normal running conditions. This avoidance of excessive battery draining/recharging is another reason for the long life of the battery.

C. Internal combustion engine:

The engines used are generally small capacity, light weight and more energy efficient than conventional engines. The 1NZ-FXE engine used in the Toyota Prius uses the "Atkinson cycle", which is a typical high expansion ratio engine, designed for high energy efficiency. These are engines that would be low powered on initial start off and acceleration, but are ideal at mid range.

D. Generator:

As with the electric motors, most new systems use a synchronous AC generator. The main achievement over recent years has been to increase the maximum rotation speed of hybrid generators, which has made it possible to produce substantial electrical power while the car is running in the mid-speed range. The typical maximum rotation speed is now around 10,000 RPM.

E. Power Split Device:

The power splitting device distributes the power produced by the internal combustion engine to the drive train and to the generator. To divide the power efficiently, it uses a planetary gear consisting of a ring gear, pinion gears, a sun gear and a planetary carrier.

F. Power Control Unit:

The Power Control Unit consists of an inverter, a Voltage-Boosting Converter and an AC/DC converter to run the car on electric motors. The inverter converts DC supplied by the battery or voltage-boosting converter to AC in order to turn the electric motors. It also converts AC generated by the generator into DC to recharge the battery. The Voltage-Boosting Converter progressively increases the normal 200-Volts DC battery supply voltage to a maximum of 650-Volts DC to feed both the electric motors and the generator. This means more power can be generated from a small current to bring out high performance from the high output motors, enhancing overall system efficiency. The DC/DC converter steps down the 200-Volts DC supply voltage from the battery to 12 Volts DC, to be used by ancillary systems and electronic devices like the ECU.

G. ECU:

As well as acting as a normal engine management ECU the Hybrid system's control unit is responsible for controlling the power distribution between electric motor and engine, for switching between the electric drive and regenerative braking functions.

III HYPER CAR DRIVE SYSTEM

H. Generate electricity from the fuel, powers wheel motors

I. Electric motors can recover part of the braking energy

J. Large decrease in engine size

K. Reduces weight, cost, fuel consumption

L. Drive system efficiency double

M. Ultra light

-1994 Average U.S. Passenger car 1439 kg
-2000-2005 Hyper car (4-5 seat) 521 kg

N. Low Aerodynamic Drag

O. Hybrid-Electric Drive system

P. Efficient Accessories

IV ADVANTAGES & DISADVANTAGES

A. Advantages

- 50-65% reduction in weight
- Easy to Manufacturing
- Smooth underbody
- Low-angle windshields
- Minimized body seams
- Aerodynamically designed air intakes, suspension, and wheel wells
- Result: 40-50% decrease in drag
- lightweight car
- Reduction in rolling resistance by 50-80%

B. Disadvantages

- High cost
- More time required for manufacturing
- Low torque
- The system is less efficient due to larger and heavier batteries
- The engine work more harder to maintain the battery charge as the system not running properly

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V APPLICATIONS

- As light duty vehicle
- Instead of moped
- Instead of hybrid car
- To a passenger car
- For public transportation

VI CONCLUSION

This study has compared a parallel range extender power train developed by Punch Power train with a series hybrid range extender power train with similar performance. For the series hybrid power train two different optimizations were applied, one focusing on load following with an optimize performance and one with a constant load requiring more buffering by the battery. Simulations have shown that the parallel range extender hybrid power train is more fuel efficient than a series hybrid power train. The load following strategy of the series hybrid is more efficient than the constant load strategy.

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