SNS College of Technology, Coimbatore-35

19MEE402 Hybrid Technology

UNIT 4- ELECTRIC VEHICLE MOTORS

Electric Drive Trains

Electric drive trains play a crucial role in the functioning of electric vehicles (EVs). The electric drive train is responsible for converting electrical energy stored in the vehicle's battery into mechanical power to propel the vehicle. There are different types of electric drive trains, each with its own set of components and characteristics. The most common types include:

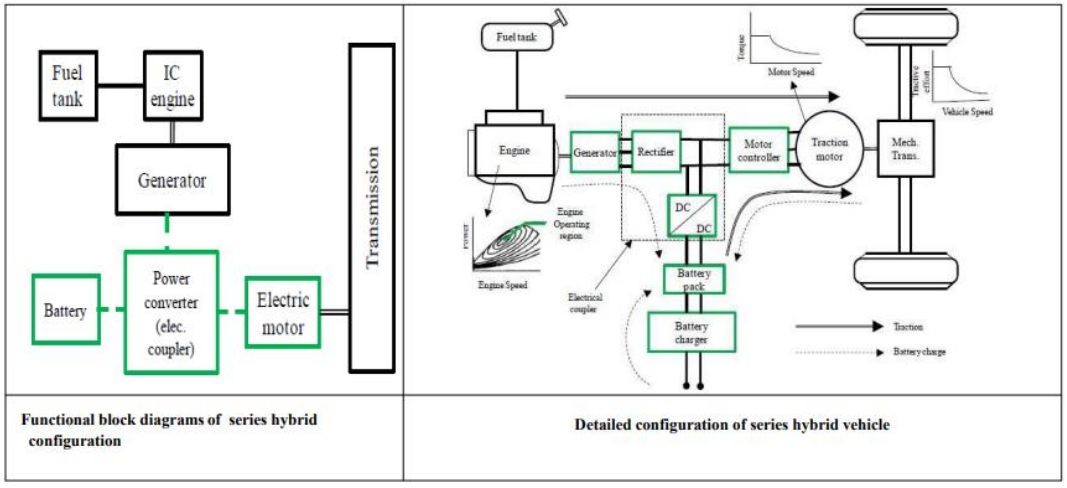
1. **Battery Electric Vehicles (BEVs):**
    - **Components:**
        - **Battery Pack:** Stores electrical energy.
        - **Power Electronics:** Converts DC (direct current) from the battery into AC (alternating current) for the motor.
        - **Electric Motor:** Converts electrical energy into mechanical energy for propulsion.
        - **Transmission:** Some BEVs may have a single-speed transmission, while others may have a multi-speed transmission.
    - **Operation:**
        - The battery pack supplies power to the electric motor through power electronics.
        - The electric motor drives the vehicle's wheels, propelling the vehicle.
2. **Hybrid Electric Vehicles (HEVs):**
    - **Components:**
        - **Internal Combustion Engine (ICE):** Works in conjunction with an electric motor.
        - **Electric Motor:** Assists the internal combustion engine and recovers energy during braking.
        - **Battery Pack:** Stores electrical energy for the electric motor.
        - **Power Electronics:** Manages the flow of electrical energy between the battery, motor, and engine.
    - **Operation:**
        - The internal combustion engine and the electric motor can work independently or together.
        - The electric motor can act as a generator during braking to recharge the battery.

3. **Plug-in Hybrid Electric Vehicles (PHEVs):**
    - Similar to HEVs but with a larger battery pack that can be charged from an external power source.
    - Typically have an electric-only driving range before the internal combustion engine engages.
4. **Fuel Cell Electric Vehicles (FCEVs):**
    - Use a fuel cell stack to generate electricity through a chemical reaction between hydrogen and oxygen.
    - The electric motor is powered by the electricity produced in the fuel cell.
    - May also have a small battery pack for regenerative braking and to provide additional power during acceleration.
5. **Wheel Hub Motors:**
    - In some EV designs, electric motors are integrated into the wheels (wheel hub motors).
    - Simplifies the overall drivetrain design and allows for better control of each wheel independently.

Electric drive trains offer several advantages, including high efficiency, instant torque, and lower maintenance compared to traditional internal combustion engines. The technology continues to evolve, with ongoing advancements in battery technology, power electronics, and electric motor design contributing to the improvement of electric vehicles' performance and range.

1. Series Hybrid System configuration

The mechanical output is first converted into electricity using a generator. The converted electricity either charges the battery or can bypass the battery to propel the wheels via the motor and mechanical transmission.

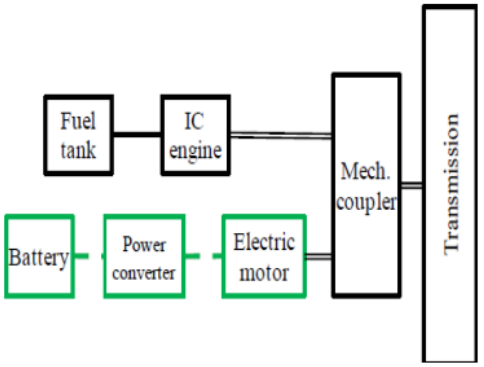


Functional block diagrams of series hybrid configuration

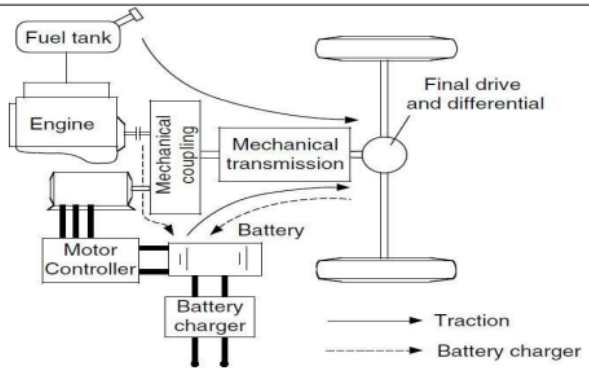
Detailed configuration of series hybrid vehicle

2. Parallel Hybrid System configuration

- ICE and electric motor (EM) to deliver power to drive the wheels.
- EM can be used as a generator to charge the battery by regenerative braking or absorbing power from the ICE when its output is greater than that required to drive the wheels.



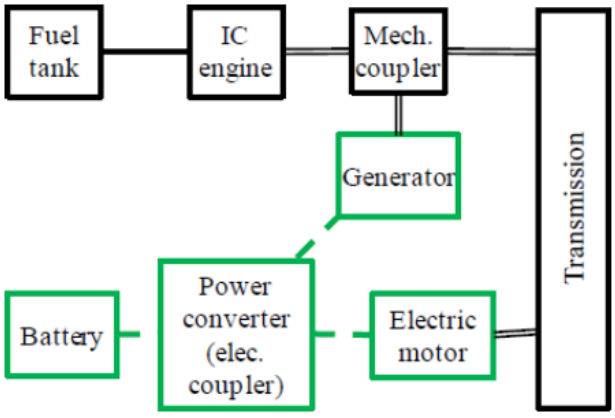
Functional block diagrams of parallel hybrid configuration



Configuration of a parallel hybrid electric drive train

3. Series-Parallel hybrid system configuration

- Incorporates the features of both the series and parallel HEVs.
- It needs an additional electric machine and a planetary gear unit making the control complex.



Functional block diagrams of Series-Parallel hybrid configuration