SNS College of Technology, Coimbatore-35

19MEE402 Hybrid Technology

UNIT 4- ELECTRIC VEHICLE MOTORS

Power flow control in hybrid drive train topology :

AIM :

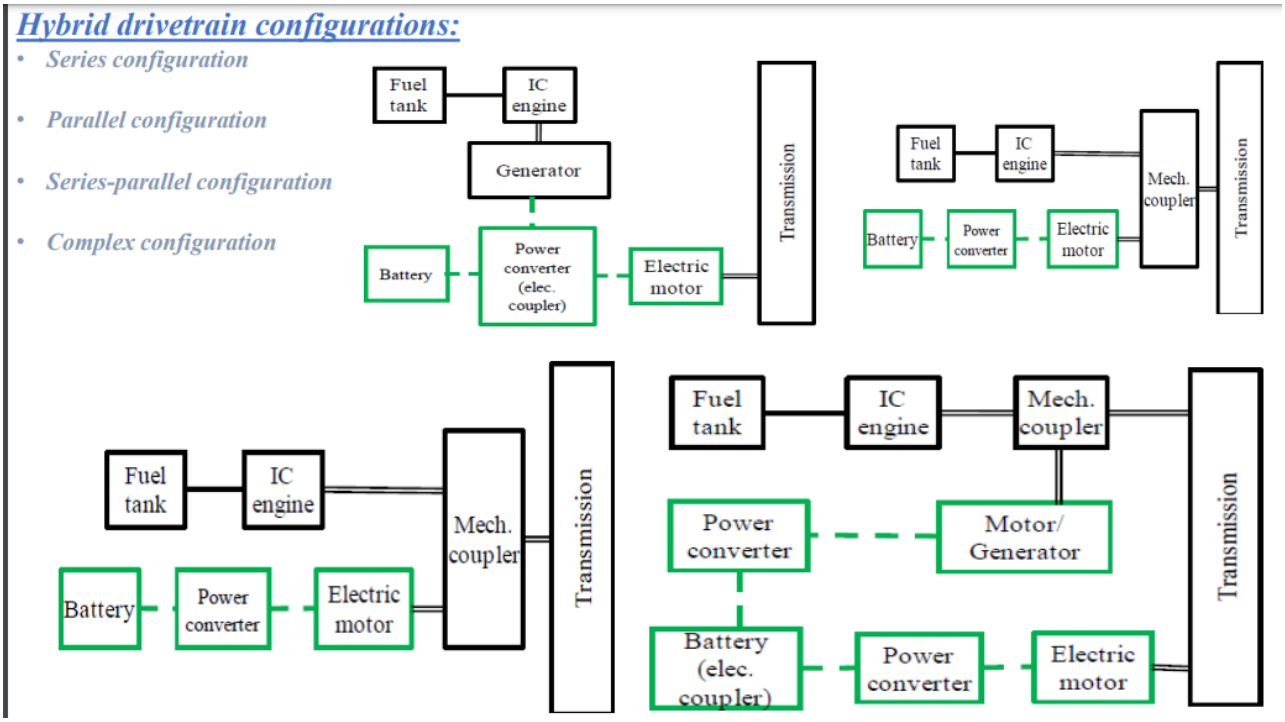
1. Maximum fuel efficiency
2. Minimum emissions
3. Minimum system costs
4. Good driving performance

Considerations :

- ***Optimal ICE operating point :*** The optimal operating point on the torque-speed plane of the ICE can be based on maximization of fuel economy, the minimization of emissions or a compromise between fuel economy and emissions.
- ***Optimal ICE operating line:*** In case the ICE needs to deliver different power demands, the corresponding optimal operating points constitute an optimal operating line.
- ***Safe battery voltage:*** ***B***attery voltage should not exceed the maximum voltage limit nor should it fall below the minimum voltage limit.

Hybrid drivetrain configurations:

- *Series configuration*
- *Parallel configuration*
- *Series-parallel configuration*
- *Complex configuration*



1 Series Hybrid Power Flow Control

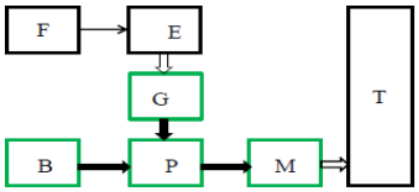


Figure 1a: Mode 1, normal driving or acceleration

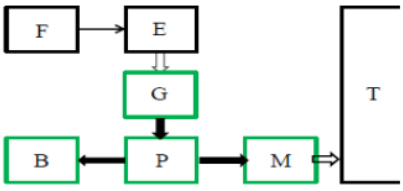


Figure 1b: Mode 2, light load

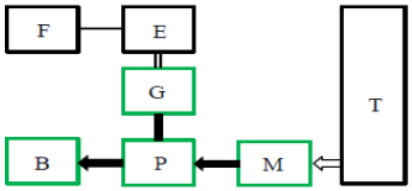


Figure 1c: Mode 3, braking or deceleration [1]

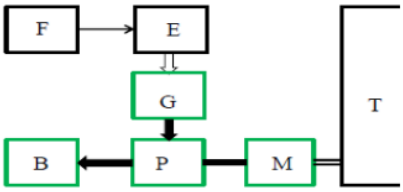


Figure 1d: Mode 4, vehicle at stop

B:Battery
E: ICE
F: Fuel tank
G: Generator
M: Motor
P: Power Converter

Electrical link
Hydraulic link
Mechanical link

T: Transmission (including brakes, clutches and gears)

- **Mode 1: S**tartup, ICE & battery deliver energy to the Power converter
- **Mode 2:** Light load, ICE output greater than required drive power. Fraction of the generated energy is used to charge the battery.
- **Mode 3: B**raking, motor acts as a generator, converts the kinetic energy into electricity and is used to charge the battery.
- **Mode 4:** The battery can be charged by the ICE via the generator even when the vehicle comes to a complete stop

2. Power Flow Control in Parallel Hybrid

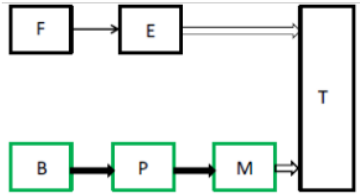


Figure 2a: Mode 1, start up

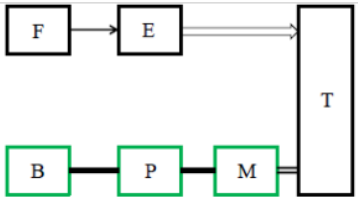


Figure 2b: Mode 2, normal driving

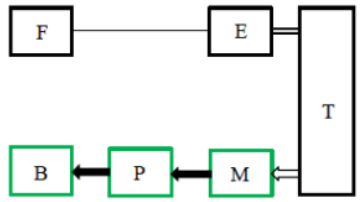


Figure 2c: Mode 3, braking or deceleration [1]

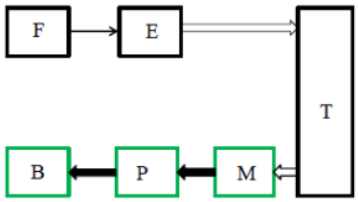


Figure 2d: Mode 4, light load

- **Mode 1: S**tart up: both the ICE and the EM share power to vehicle. Relative distribution between the ICE and electric motor is 80-20%.
- **Mode 2:** Normal driving: required power is supplied by the ICE only and the EM remains in off mode.
- **Mode 3: B**raking: the EM acts as a generator to charge the battery.
- **Mode 4: L**ight load condition : traction power is delivered by the ICE and ICE also charges the battery.