Regen Braking

What is Braking?

Conventional braking utilises brake rotors or drums to slow the vehicle though the application of brake pads or shoes. The brakes are applied by hydraulic pressure generated when the footbrake pedal is pressed. These pads are applied with considerable force towards the sliding braking surfaces, thus causing frictional forces that oppose the direction of motion.

Electric Vehicles

Electric vehicles (EVs) contain an internal battery and motor to power the car. Environmental pressures and regulatory shifts have led OEMs to increase adoption of this new technology across their platforms. Long-range capability, rapid charging, battery production and charging infrastructure are all areas of intense focus. One third of new vehicles in the EU will be electric or hybrid by 2026.

Electric Vehicle Benefits

The environmental advantages of EVs are two-fold, firstly the tailpipe exhaust emissions are reduced to zero and secondly the lifecycle carbon emissions are lower than that of their gasoline/petrol counterparts. The latter is true for energy generation by all but the worst polluting electricity networks.

The scientific consensus is that increasing use of fossil fuels has directly contributed to global climate change. Greenhouse gasses trap heat in the atmosphere by reradiating infrared heat energy back to the Earth's surface. This cycle is responsible for the gradual warming of global temperatures.

What is Regen Braking?

Regenerative braking, as the name suggests, can generate electrical energy by means of converting the kinetic energy of the moving vehicle during braking. This type of braking is only possible on vehicles with electric drivetrains such as hybrid electric vehicles (HEVs) or battery electric vehicles (BEVs).

How Regen Braking Works

The electric motor used to drive the car can be used just as easily as a generator. When the regenerative braking mode is selected, electricity is generated, and a resisting torque slows the vehicle to a stop. Any generated electrical energy is stored within the battery system. The efficiency of capturing this energy ranges up to 70 %. This helps to increase the range of the vehicle by topping up energy as and when braking events arise.

The energy present in a moving vehicle is directly linked to the mass and velocity, where for standard brakes the near entirety of this energy is converted into heat at the frictional interface. Regen usage brings a consequent reduction in wear of the conventional brakes. Particulate matter emissions released during braking include micro particles with an array of negative health consequences.

Range Extension

The generation of additional charge maximises the range available to the driver. It is reported that a range extension of 10 – 15 % can be achieved from certain urban driving conditions. This combats what is referred to as "range anxiety", one key concern for large scale EV adoption.

Current Limitations

Regenerative braking is limited in the types of braking event that it can handle. High energy stops such as emergency braking are beyond the limits of current regenerative braking. Regen is supplemented with standard friction brakes and on-board electronics must decide what braking system to use for each stop, often blending the two for optimal performance and safety. When the battery is fully charged, the hydraulic brakes are required.

The Future of Brake Rotors

As regenerative braking becomes a more commonly used technology, the size of brake rotors is likely to reduce. Conventional braking systems comprise over 100 kilograms of un-sprung mass. We could see a reduction in permissible wear allowances to cater for lower brake applications per unit km, concomitantly seeing benefits with mass and CO_2. Such potential rightsizing would reduce the quantity of material cast per brake rotor.

Development of improved regen braking performances will allow for future rotor downsizing and potential eventual replacement by another kind of mechanical failsafe mechanism, to cover the event of regenerative braking failure. Rolling resistance reduction will be instrumental for both range extension and efficacy of regen braking recovery.

This is a change in market technology that MFG will pay close attention to as product portfolios adapt in the OE and Aftermarket sectors.

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