Types of Regenerative Braking

Chandler Hwe, Mechanical Engineering
Dr. Mehrdad Haghi
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What is Regenerative Braking?

Regenerative braking is a system in which an object or vehicle is slowed down by converting the moving kinetic energy into stored energy, which can then be used at a later time. This method of braking is much more efficient that conventional braking, which converts the moving kinetic energy of a vehicle into wasted heat energy due to friction.

Types of Regenerative Braking

Kinetic Regenerative Braking

Kinetic regenerative braking involves converting the kinetic energy of a moving object into another form of kinetic energy. The most common case of this regeneration is storing the initial kinetic energy into a flywheel, a rotational mechanical device used to store energy. When the kinetic energy of the moving object is applied to a flywheel, a torque is applied to the flywheel increasing its speed, thus its stored energy.

One of the main flaws of implementing a flywheel as a means of regeneration is that having a heavy mass spinning at high rotational speeds poses a threat to the safety of the vehicle. If the flywheel were to come apart, spinning pieces with high velocities could tear through the car. Another concern that comes with flywheels is that the spinning mass can cause unwanted gyroscopic effects, unbalancing the vehicle during transit.

Electrical Regenerative Braking

Electrical regenerative braking involves converting the kinetic energy of a moving object into electrical energy. The most common case of this regeneration is electrically or physically reversing a motor capable of regeneration . As the drive shaft of the motor is turned opposite to the direction the motor is configured, backward electromagnetic fields provide backward torque and store energy.

Although this is the main type of regenerative braking seen today, there are many energy losses throughout the process. Energy loss occurs as the kinetic energy of the moving car is converted into electrical energy by the generator. Further loss occurs as the electrical energy is converted into chemical energy as it is stored in the battery. The same losses occur in reverse order as the chemical energy is converted into electrical energy which allows the motor to create kinetic energy that drives the car.

Considerations for the Future

Current regenerative systems have limitations to the amount of braking force they can apply to an object given a specific amount of time. Today's regenerative braking vehicles are forced to maintain a conventional braking system for use in heavy braking, adding not only weight but maintenance to the vehicle. If the efficiency and effectiveness of braking systems could be improved, then not only would the amount of energy regenerated be increased, but the need for conventional braking could be eliminated.