FABRICATION OF REGENERATIVE BRAKING SYSTEM

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Abstract

In recent years, there is the lack of reliable alternative energy sources, increasing efficiency and reducing exhaust gas emissions has become the focus of the modern automotive research.Commercial vehicles such as refuse trucks and delivery vehicles lose a tremendous amount of kinetic energy during frequent braking and constant drive at low speeds on designated city routes, which results in higher fuel consumption and Green House Emission Gas(GHG) emission thanother on-road vehicles. Numerous attempts have been made to improve type of vehicles. The technological combination of Exhaust Gas Recirculation (EGR) and Diesel Particulate Filter (DPF) after treatment is one of the effective ways to solve the vehicle emission, especially for NOxandsoot. However, this method is not able to reduce the GH Gemission since the low temperature combustion of this technology results in increasing the fuel penalty. Sacrificing engine efficiencyin exchange for reduced pollutants cannot fundamentally solve the energy crisis. In order toachieve overall GHG reduction targets, a strong reduction is needed particularly for commercialvehicles.

1. INTRODUCTION

Regenerative energy technology is one of the key features of electrified vehicles. It allows the vehicle to captureatremendous amount of the kinetic energy lost during braking or decelerating for reuse. That is saying, energy recovery technology can significantly bring downthe energy consumption of electrified vehicle, particularly in urban operated route. Generally,there are two regenerative energy approaches which have been applied to commercial vehicles:Regenerative Braking System and Boost Recuperation System. The former is usually applied inseries hybrid architecture; the latter in the parallel architecture. The regenerative braking system is equipped in the driven axle to recuperate the braking energy loss. The boost recuperation system is parallelly coupled with the mechanical propulsion system to recuperate kinetic energy duringthe deceleration process. Both technologies allow commercial vehicles to have a significant improvement of reducing fuel consumption as well as emissions. However, few researchers have address ed the regenerative energy rate of hybrid commercial vehicles. The more energy the regenerative braking recuperates; the less fuel is consumed. Typical hybrid commercial vehiclesaregenerallydesignedasreardriveandt heregenerativebrakingsystemisequippedinrea rdrivenaxle(es)torecuperatethebrakingenergyl oss.Duetothechangeofthecentergravityinheve

hicleunderdifferent loadconditions, brakingenergy lossmay varyin bothfrontandrearaxles.Current braking research indicates that around 50-80% of braking energy loss of commercialvehicles occurs in the front axle and the braking energy loss varies slightly under different loadstates.Therefore, themajority of theregenerativeenergy potential is not taped.

2. WorkingPrinciple

Regenerative braking is a braking method that utilizes the mechanical energy from themotor by converting kinetic energy into electrical energy and fed back into the battery source.Theoretically,theregenerativebraking systemcanconvertagoodfractionofitskineticen ergytochargeup thebattery,using the same principleasan alternator.

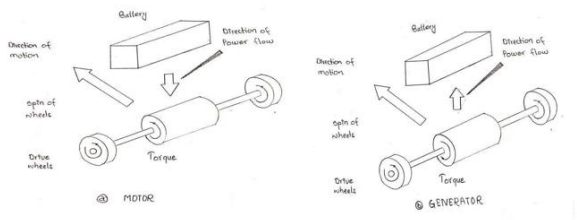

Fig 1. Normal forward driving condition Fig 2: Regenerative action during braking |

In regenerative braking mode, it uses the motor to slow down the car when the driverappliesforcetothebrakepedalthentheelec tricmotorworksinreversedirectionthusslowing thecar.Whilerunningbackwards,themotoracts asthegeneratorandrechargethebatteriesasshow nin figure (1.2.2). Meanwhile in figure (1.2.1) shows the car in normal running condition whereasthe motor turning forward and taken energy from the battery. By using regenerative braking, itvastlyreducestherelianceonfuel,boostingfuel economyandloweringemissions.Thesetypesof brakes work effectively in driving environment such as stop-and-go driving situations especiallyinurbancity.

3. METHODOLOGY

Regenerative braking system may not suffice the basic requirement of braking systemalone. This is because of limitation of energy dissipation at very high power. The storage andgeneration systems may notbe capable to operate at those levels due to design limitations. Due tocritical level of safety involved with the system, reliability becomes debatable and it necessitatesafrictionalbrakingsystemtoco-existwithelectricalregenerativebrakingsystem .Thisformsahybrid braking system, which means:Justlikehybridpropulsionsystems,there canbemanydesignconfigurationsandcontrolstr ategies.Designandcontrol ofsystemshouldbesuchthattheyensurevehicle' sdesiredbrakingperformancewhileat thesame timecapturing asmuch energyas possible.During developing strategies, a careful consideration of braking behavior and its characteristicswithrespectto speed, braking power,decelerationrateetc. must bemade.Braking efficiency is a crucial aspect of safe driving. It is the ability of a vehicle's brakesystem to effectively stop the vehicle in motion. A vehicle with good braking efficiency is lesslikely to be involved in an accident. Braking efficiency is a measure of how well a vehicle can slow down and stop.It

is affected by factors such as road conditions, speed, and the quality of the car's braking system. Good braking efficiency is essential for safe driving, especially whenunexpected conditions arise.

4. FABRICATION

ListofMaterialsusedinFabrication

Table3.2.1:List ofMaterials

Sr. No	Name of Parts Used	Description	Quantity
1	Square bar	40*40 Hollow Bar (M.S)	8m
2	Journal Bearing	Internal Dia.12mm	2 piece
3	Brake Wheel	Outer Dia.8cm	1 piece
4	Solid Shaft	Outer Dia.12mm	1.5m
5	Bicycle Wheel	Inner Dia. 12 mm	1 piece
6	Brake Spindle	40*40 Hollow Bar (M.S)	0.6m
7	Sewing Machine Motor	9500 rpm	1 piece
8	Pulley	Internal Dia.12mm	2 piece
9	Pulley Rope	V-belt	0.5m
10	LEDs	12v	6 piece
11	Electric Wires	Copper wire	6m
12	D.C Motor	Brushed D.C 12v	1piece

FinalFabrication

Fig.3 FinalFabrication

5. Conclusion

Theregenerativebraking systemusedinthevehiclessatisfiesthepurposeof savingapartoftheenergylostduringbraking.The regenerativebrakingsystemisdesignedtopartial lyrecoverthe battery charge wasted in braking of the vehicle. The energy is converted into heat by frictionbrakeswhich are dissipated to the environment. This Energy is utilized to rotate the rotor ofgenerator converting mechanical energy of wheels into useful charge of battery. The regenerativebraking system cannot be used as main braking system of vehicle as it cannot bring the vehicle torest.Experimentally it is found that, on increasing the speed of the wheel (rpm) the voltagegenerated will also be increasing and vice-versa. As others researchers had used stepper or servomotors as regenerative motor, so in this project, it is replaced with D.C motor. motor with gear. Ithasbeenfoundthatthevoltagegeneratedbythe D.Cmotorwithgearishigherthanthatofvoltagep roducedby those two motors. Hence, if this system is installed in the actual vehicles minimum 11% battery energy can berecovered using the regenerative braking system which would otherwise be wasted to heat infriction brakes. So the distance travelled between two successive charging requirements can beincreaseto 10 to 15 %using this regenerative braking.

6. FutureScope

Future developments, however, such as ultra-capacitors, flywheels and hydraulic systemscouldhavemuchhigherpowercapacitie s,whichcouldopenupthepossibilitytorelymore heavilyon the regenerative braking system, even for high speed, high stops and the opportunity todownsizeor even eliminate the friction-braking system. Regenerative Braking system is a usefultechnology to restore the kinetic energy which will fade away in heat produced during friction.This system is useful in improving the fuel economy ofthe vehicle and also in increasing theefficiency of the system. Nowadays, Most of the car manufacturing companies use this

system toincreasethevehicle's parts lifeand to limit theemissions.

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