ISSN 2395-1621

Suspension Air Conditioning using Refrigerant

[#1]Pranav Ramnath Khamitkar, [#2]Sayyed Hasan AbbasGulam Abbas,
[#3]Abhishek Mahadoev Khilari, [#4]Hussain Mustafa Sutarwala

[1]pranav2fly@gmail.com
[2]sayyedhasanrizvi@gmail.com
[3]abhishekkhilari07@gmail.com
[4]hussainsutarwala787@gmail.com

[#1234]Student, Department of Mechanical Engineering

Trinity college of Engineering and Research

ABSTRACT

Now a day we have required fuel efficient car. But the engine of the cars is not efficient when the load on car is high. For this purpose we have to reduce the load on engine that is to run the AC and Compressor. Instead of engine power we are used the suspension system for producing compressed refrigerant and AC effect Vice- Versa. Current air-conditioning systems can reduce the fuel economy of high fuel economy vehicles. And also in previous days there is wastage of energy in suspension system that is linear motion of suspension system, which is also use for compress the refrigerant by using piston-cylinder arrangement. By using this compressed refrigerant we can run AC system in the car and save fuel economy. After this research we concluded in car there is a lot of fuel burn only for working of A.C. while driving the car. If A.C. will run on other system rather than fuel then there is lot of fuel save in car hence the efficiency of car will also increases.

Keywords: Air-conditioning, suspension system, refrigerant.

ARTICLE INFO

Article History

Received: 30th May 2018

Received in revised form :

30th May 2018

Accepted: 3rd June 2018

Published online :

4th June 2018

I. INTRODUCTION

In automobile the suspension system is essential to absorb shocks, vibration and bumps etc. Vehicle is run on different type road conditions such as even, uneven, rough etc. The automobile frame and body are mounted on front and rear axle through springs and shock absorbers. This is essential to damp out road shocks transmitted to the frame by the wheels when they roll over uneven road. This creates discomfort to the passengers and produces stresses in the frame and other parts of the automobile. The passenger experiences the jolts by the forward movement of the vehicle and jerks due to uneven road conditions. Even under good road condition the passenger are also subjected to bounce and roll when cornering and pitch when the front wheels are suddenly lifted or dropped in relation to rear wheels that means suspension system work continuously.

Due to varying conditions of heating, ventilating, cooling and dehumidification in the atmosphere at various places, the air conditioning of automobiles is very essential. To maintain human comfort and improve internal atmosphere in an enclosed space, proper control of freshness, temperature, humidity and cleanliness of the air is required. So, in this project we are using renewable energy of suspension system to produce air conditioning effect in automobile.

Problem Statement:

Previously in conventional vehicles there is wastage of energy in vehicle suspension that is kinetic energy. This kinetic energy present during driving resulting from the movements of the suspension of the vehicle wheels. Also in vehicle the AC is essential parameter for human comfort. But for running AC required large power. Hence the power of engine was distributed and efficiency of vehicle decreased. The AC effect was produced by compressor which was driven by engine. To overcome these effects we have to use the linear motion of suspension system to compress the refrigerant by using piston-cylinder arrangement. By using this compress refrigerant we can run AC system in the car and save fuel.

Objectives

AC System Using Vehicle Suspension using refrigerant which have following objectives

a. Recover waste energy of suspension system.
b. Save fuel which is burn for working of AC

c. Run AC on waste energy of suspension system.
d. To increase the mileage of vehicle.

II. LITERATURE SURVEY

Abhijit Lendhe, Nikhil Mangvade, Prasad Naik, Pratik Jadhav
The conventional vehicle suspension dissipates the mechanical energy i.e. potential and kinetic energy. In spring potential energy is stored and kinetic energy is wasted. The aim of paper is this wasted energy is compressed by using single acting cylinder by proper arrangement. The main aim of this paper is the compressed air production using vehicle suspension is given to the air conditioning system. The pushing power is converted into compressed air energy by proper arrangement .The pneumatic single acting cylinder is used for this project to compress the air. The output air from the pneumatic cylinder is collected through quick exhaust valve and non return valve and this compressed air stored inside the storage tank. After this research we concluded in car there is a lot of fuel burn only for working of A.C. while driving the car. If A.C. will run on other system rather than fuel then there is lot of fuel save in car hence the efficiency of car will also increases.

Vladimír Gogaa, Marian KĐúþik
The main purpose of vehicle suspension is to achieve good driving stability and passenger comfort regardless of road surface. These requirements are often contradictory. This article aims to show the possibilities offered by a combination of modeling in a virtual environment and evolutionary computation in the process of optimization. Mathematical half-car model was created in Matlab/Simulink. Passive suspension parameters (damping and stiffness coefficients) were optimized with use of evolutionary computation. Results from simulations of model with original and optimized suspension parameters were compared.
Optimization criteria were passenger comfort (vertical and angular accelerations of vehicle body) and driving stability (contact wheels with road). Each criterion had the same priority. Optimization was performed use with Matlab/Simulink via mathematic model of halfcar model. Results for model with optimized parameters show significant decreasing of amplitudes and faster stabilization of measured quantities against results of model with original parameters. Generally passive suspension is not ideal to achieve good driving stability and passenger comfort therefore semi-active and active suspensions are more expanded. Future work will be oriented to use genetic programming for design and optimization parts of semi-active and active suspensions.

S.C. Pang, M.A. Kalam , H.H. Masjuki, M.A. Hazrat Department of Mechanical Engineering, University of Malaya, 50603 Kuala Lumpur, Malaysia
Engine cooling system plays an important role to maintain the operating temperature of engine. The coolant circuit initiates by picking up heat at water jackets. With the pressure gradient exists in coolant circuit, hot coolant flows out from engine to radiator or to bypass circuit (during cold start). The under hood air flow carries heat away at radiator after the air flows through numerous hood components. The coolant flow circuit and air flow circuit meet each other and exchange heat at radiator. Extensive researches are carried out to study vehicles' cooling system extensively either numerically or experimentally. The research covers many individual topics which include numerical modelling of engine cooling system, under hood air flow, heat transfer at water jacket, heat transfer at radiator and coolants' after-boiling phenomenon. In numerical modelling, integration of several simulations is required to represent the whole vehicles' cooling system. CFD simulation is always a better option to model under hood air flow. Thermo-fluid simulation is always chosen by researchers to model the coolant circuit. The existence of pressure gradient provokes the air flow at under hood. Researchers derived grille coefficient by normalization of total pressure at hood. Research regarding heat transfer at water jacket and radiator could provide some insight about how to improve the whole cooling system. Researchers could find out which is the components with higher thermal resistance and could eliminate the obstacles for heat transfer. The study in after-boiling-phenomenon helps to highlight among the crucial problem for engine cooling system.

Gao Zepeng , Nan Jinruia, Liu Liana, Xu Xiaolin
In order to solve the suspension overshoot phenomenon existing in the static regulation process of the electric vehicle with electric controlled air suspension, firstly, the relevant factors of air spring are analyzed and the characteristics of the gasbag are simulated and verified in AMESim. Secondly, the model of the electric vehicle body is analyzed according to the law of dynamics and the fuzzy control theory is used to set up the electric vehicle body model in Simulink. In the case of unbalanced load, the effectiveness of the fuzzy controller is used to simulate the phenomenon of "overshoot" in the system.
According to the mechanical equation and gas state equation, using AMESim to analyze the characteristics of air spring and establish the dynamic differential equations of 1/4 vehicle model and seven degrees of freedom vehicle model with air suspension system. Then, establishing corresponding body model in Simulink. The results show that the ECAS system can improve the vehicle ride comfort.
b) Aimed at the "Suspension overshoot" phenomenon appeared in the process of simulation, the fuzzy control theory is applied into the process of air suspension control. Height difference and its change rate and the left and the right height difference as input and the PWM signal controlling solenoid valve open and close as the output. Comparing with the simulation results, the fuzzy controller can solve the problem of "overshoot" and improve the control effect.

Lu Sun
A methodology on the concept of optimum design of a road-friendly suspension to attenuate the tire load exerted by vehicles on pavement was developed in this paper. The probability of the peak value of the tire load exceeding a certain given value is determined as the objective function for the optimum suspension design. A walking-beam suspension system traveling at the speed of 20 m/s was used

in a case study. The numerical results showed that tires with high air pressure could lead to more damage in pavement structures, and increasing suspension damping and tire damping can reduce the tire loads and pavement damage.
In an earlier study Collop and Cebon [8] used a simple road damage analysis based on the fourth power law. The result showed that road-friendly suspension does not have significant effect on thick pavement damage, however, it does reduce thin pavement damage. More studies need to be done in the future work to compare different research results.

Khaled S. AlQdah
This work presents an experimental study of an aqua-ammonia absorption system used for automobile air conditioning system, this system using the exhaust waste heat of an internal combustion diesel engine as energy source. The energy availability that can be used in the generator and the effect of the system on engine performance, exhaust emissions, auto air conditioning performance and fuel economy are evaluated. Because automotive air conditioning is one the most equipment that heavily uses CFC compounds and the leakage of CFCs from such air conditioners impact on the environment. The main purpose of this investigation to explore the feasibility of using waste energy to design the absorber and generation since these components are the most important components of absorption and they are directly influence the performance of the whole system. It has been found that the aqua -ammonia concentration effect the cooling capacity. The estimated cooling load for the automobile found to be within acceptable ranges which are about 1.37 ton refrigeration. The obtained results show that the coefficient of performance (COP) values directly proportional with increasing generator and evaporator temperatures but decrease with increasing condenser and absorber temperatures. Measured values for generator, absorber, and evaporator and condenser temperature were recorded and the coefficient of performance of the system varied between 0.85 and 1.04.

III. PROPOSED SETUP

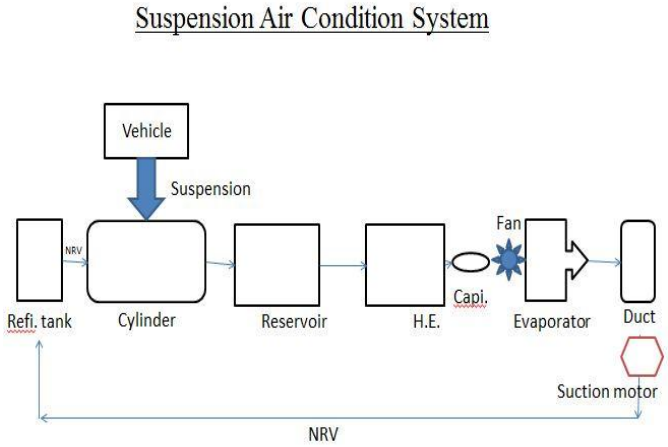


Fig 1. Arrangement of Setup

The vehicle frame is bounce per suspension of vehicle. In figure the frame is push manually by hand. The suspension mechanism is connected to the Rack And Pinion System To the piston rod end and move the piston inside the cylinder mounted on the base frame and this movement of piston causes the suction of air from the atmospheric air when piston moves from Bottom dead centre to Top dead centre and compresses the air when piston moves from Top dead centre to Bottom dead centre.
The outlet port of cylinder is connected the T connector, this connector two port is connecting the non-return valve one valve is open to atmosphere and another is connecting the hoses pipe and supply the compressed air in air receiver. All pressurized air come in tank from cylinder through the pipe connection. The air tank having two ports one is for pressurized air coming from cylinder and other one is supplied the compressed air as per requirement.
The ball valve is fitted to the inlet and outlet of the air tank to control the flow of the pressurized air. And pressure gauge is fitted at other side to show the pressure of the compressed air stored into the air tank. This ball valve is connected to hoses and air is supplied to Heat Exchanger. The heat exchanger is used for exchanging heat from one medium to another working medium.
The heat exchanger used is tube and tube type. The air is supplied inside tube and cooling liquid (water) is supplied outside of tube for producing cooling effect. This cooling liquid is store in air tank which is shown in figure. And supply the cooling liquid in inlet port of heat exchanger which is located at the top side of the heat exchanger. Then used water is drain from outlet port which is located at the bottom side of the heat exchanger.

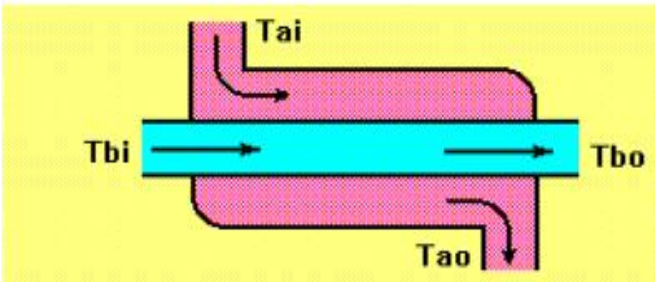
IV. ANALYSIS RESULT

Heat exchanger: - It is used to exchange the heat between two medium in which heat transfer is takes place from high temperature to low temperature and maintain the temperature at mean temperature. There are two main types of shell and tube heat exchanger,

1. Parallel flow heat exchanger

2. Counter flow heat exchanger

We are using parallel flow shell and single tube heat exchanger in our project.



It is used to exchange the heat between two medium in which heat transfer is takes place from high temperature to low temperature and maintain the temperature at mean temperature.

Fig 2. Heat exchanger setup

Evaporator

The evaporator is main component of a refrigeration system in which heat is removed from air, water or any other body required to be cooled by the evaporating refrigerant. The refrigerant boils or evaporates in this component and absorbs heat from the substance being cooled which is the main purpose of a refrigeration system. The name evaporator refers to the evaporation process occurring in the heat.

Fig.2. Evaporator

Classification of Evaporators

There are several ways of classifying the evaporators depending upon the heat transfer process or refrigerant flow or condition of heat transfer surface.

1. Natural and Forced Convection Type
2. Refrigerant Flow Inside or Outside Tubes
3. Flooded and Dry Type
4. Natural Convection type evaporator coils
5. Flooded Evaporator
6. Shell-and-Tube Liquid Chillers
7. Plate type evaporators
8. Plate Surface Evaporators
9. Direct expansion fin-and-tube type

Capillary tube

An analytical computation of length of capillary tube the fundamental equations applicable to the control volume bounded by points 1and 2 in fig.3 are,

1. Conservation of mass
2. Conservation of energy
3. Conservation of momentum

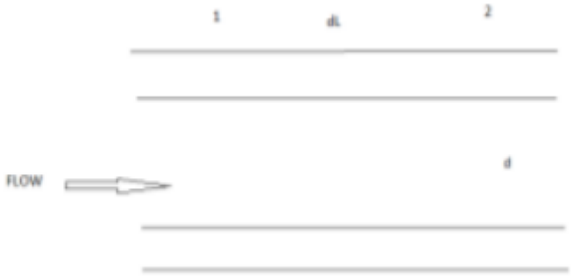


Fig.3. Small elementary length of capillary tube

V. CONCLUSION

This system is made with pre planning, that it provides flexibility in operation. This project regenerative suspension system" is designed with the hope that it is very much economical and help full to all vehicles to produce the compressed air. This project helped us to know the periodic steps in completing a project work. Thus we have completed the project successfully. It has been a great experience while completing our project we come across lot many practical knowledge as well as experience. We had an opportunity to learn how project are been done. We received a lot of practical experience while working on this project as well as got enough freedom to our ideas for the improvement in our assigned project and check whether ideas are fruitful. Therefore the design must be as perfect as possible and special attention is given during each manufacturing activity.

REFERENCES

1. Lu Sun, "Optimum design of ''road-friendly'' vehicle suspension systems subjected to rough pavement surfaces", Applied Mathematical Modelling (2002), Vol. 26, pp. 635-652.

2. Khaled S. AlQdah, "Performance and Evaluation of Aqua Ammonia Auto Air Conditioner System Using Exhaust Waste Energy", Energy Procedia (2011), Vol. 6, pp. 467-476.

3. Rajesh Kumar Sahu et.al. , "Fabrication of a Device Used For Producing Compressed Air Using Vehicle Suspension", International Journal of Engineering Studies and Technical approach (2016), Vol. 2 No. 4.

4. Honghyun Cho. et.al, "Performance characteristics of an automobile air conditioning system with internal heat exchanger using refrigerant R1234yf", Applied Thermal Engineering, (2013), Vol. 61, pp. 563-569.

