



Optimization of Interior Spacing in Car with Help of Air Inflatable Seat

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ABSTRACT

Automobile plays an inevitable role in the present world for transportation of people and goods. Much advancement has done in automobiles to increase various aspects like aesthetics, safety, comfort and engine performance etc., among this, one of the major requirements of modern automobiles is to increase fuel economy. Every design modification that has been made in automobile will need to meet with requirement of increase in fuel economy and engine performance. On considering Indian consumers, their usage and requirements are multipurpose. Their requirement is about having comfortable seating and also having additional space for goods, if the need arise. To comply with above requirement of Indian consumers with improved fuel economy, various concepts are discussed. One among the factor was seat weight. This can be modified by implanting inflatable seats in automobile.

Key Terms: Seat design, Spacious, fuel economy

1. INTRODUCTION

Today world has become more connectivity via technology. People start to explore more places for adventure. Many people will not opt for common transport, so people tend to have own transportation so that they can schedule their own trip as per their wish. On other hand many startup companies and entrepreneur has been emerged. Their transportation need is low, at level of one – two trucks can satisfy their requirement. So they can transfer their products and goods in low cost. Cars with multiple seating can't offer enough storage space. Likewise trucks can have storage space but not having multiple seating. This shows that it's a problem without solution. Our piece of idea was a small attempt to solution for this problem. On other hand, carrying heavier loads in cars, more amount of fuel is consumed which lead to excess co2 emission takes place and creating air pollution in the environment. So if seats are in less weight and if they can be packed to small area, these above problems can be rectified. Seats are one of important components in automobile vehicle where the passengers spend most of their time. The function of the car seats is to provide the comfortable seating posture, support and protect. According to recent trends where the driver and passenger like have comfortable seats and high safety while driving. On designing the car seat according to human comfort, various factors should be taken into consideration, like pressure distribution, load, and flexibility. Engineering design of the seat should satisfy the geometric parameters of seats and proper cushion materials. Major interior space was occupied by seats. Removal of seat is also time consuming process. This factor causes a serious issue and differentiates the trucks and cars. Main reasons of this problem were weight and unfold able nature of foam seats. Our concept of idea is to replace the foam seats with air inflatable seats. These seats can be light weight, easily removable and low cost.

2.RECENT TRENDS

Everyday more modification has been take place in automobile industry. On considering car seats, more modifications and advancement has been occurred. INFANT SEAT is also best example for recent trends in car seats. Thus on searching for different needs, several concepts and design has been emerged. Likewise on considering Indian consumers need we have proposed the idea of air inflatable seat.

3.METHODOLOGY

The methodology is the general strategy that gives the way in which the project is to be carried out and helps to the method to be used in it. Our method is a continuous process purely based upon the step by step procedure starting from design to documentation.

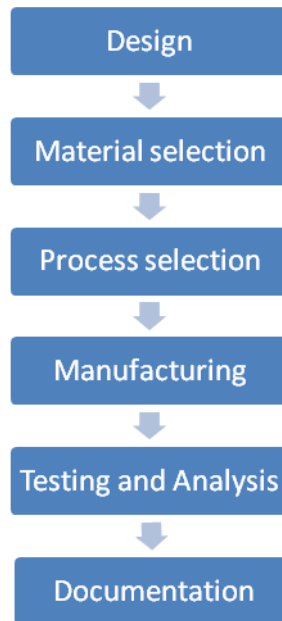


Fig.1

3.1 Design

The basic information of seat structure design is collected from journal and text books. The design of the seats as per human comfort is also provided from the basic assumption at the concept level of seat design. As the result of design parameters, human must feel comfortable.

To define the design of air inflated seats, following factors are very important:-

1. Length and Breadth of frame.
2. Length and Breadth of seats (back & bottom)
3. Angle between the seat cushion.
4. Mode of Attachment between seat and frame.

3.2 Material

There is a wide variety of polymer material available in market to manufacture an air inflated seats. On considering the basic requirements of seat and safety, the material must be selected. The air inflated seats should be capable to have high flexible and stiffness.

In general, the seating structure should with stand heavy loads. On basis of above conditions, the following material from different grades will be validated.

- Seat material – Low density polyethylene(LDPE)

Since the weight to hold is less comparing to foam seat, and to provide basic aspects of frame, the following material is choosen.

- Frame material- Structured steel

3.3 Modeling and Drafting

Model of air inflated seat is done with help of solid works software. Air inflated car seat has been represented below:

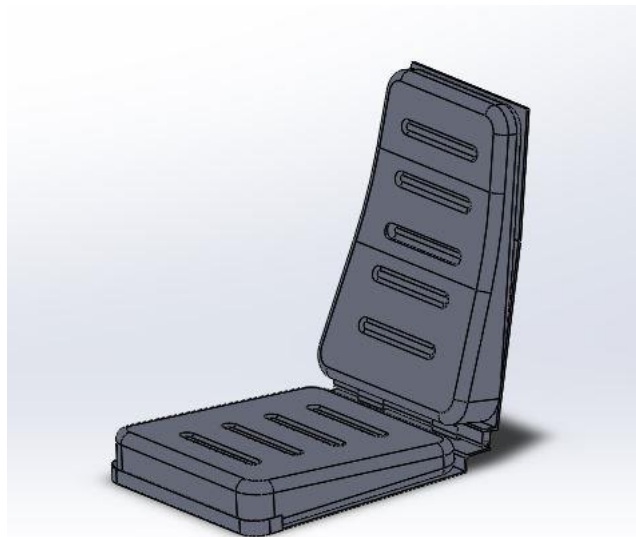


Fig 2 Air inflatable seat assembled with frame

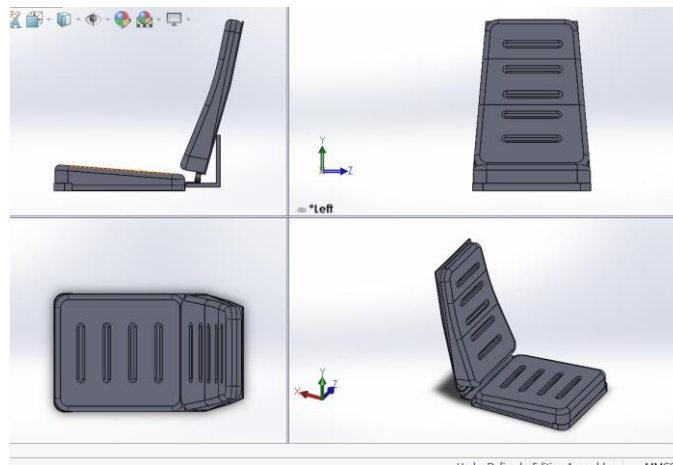


Fig 3 Different views of the air inflatable seat

3.4 Manufacturing

The manufacturing technique which has been employed for air inflatable seats is HOT PRESSING. This is because polymer layer act as seat only if sufficient amount of air is locked within them. There should be no air leakage take place and bonded areas should with stand high pressure during load applied by passenger. On considering the factor, hot pressing is chosen. It can satisfy the above requirements.

3.5 Components and Working

The air inflatable seat is enclosed on all sides with only one opening for valve. Here we have used Boston valve. These type of valve are best to lock the air within the compartment. This type of valve comes with cap so that it provide extra support and also prevent dust particles get deposited. The air is filled within 3minutes with help of blowers. Blower with 5 voltages is enough to fill the seat. Blower will be small for 5 volts, so that it can't occupy much space and also it can be used anytime, if needed. Thus the air is filled with help of blowers and maximum time consumption will be about five minutes. The seat can empty within ten minutes. The frame structure can be folded, so that after empty the air completely, seat material can be safely covered within frame.

3.6 Testing and Analysis

3.6.1 Inflation test

The test involves proper inflation of seat to check any leakage of air around the seat. The inflate seat is filled with air using the pump and then immerse the seat in water for the period of time to check , if there is any possible of formation of bubble around the seat must be replaced with another seat.

3.6.2 Comfort test

The seat must provide more comfort to human. we have focused on the free movement of the human in the seat in static condition of vehicle and providing proper contact between the human buttock and seat cushion. Pressure measurement method for seat developers to measure the comfort and discomfort of seated person.

Table . 1 Causes of Seat Discomfort

Human experience mode	Biomechanical		Seat / environment
Pain	Physiology causes	Engineering causes	source
	Ischemia	Pressure	Cushion stiffness
Pain	Circulation occlusion	Pressure	Cushion stiffness
Pain	Nerve occlusion	Pressure	Seat contour
Perspiration	Heat	Material breathability	Thermal conductivity

3.6.3 Load test

Most important testing is the load test is done with help of ANSYS software and the load is given at increasing order of weight. The weight is given in terms of Newton and the results for each amount of load has been analyzed and documented. The following tabular gives the various load and its impacts

Table 2, Load Test

<i>Load (newton)</i>	<i>Deformation (mm)</i>	<i>Stiffness</i>
150	0.1939	Strong
290	0.3872	Strong
440	0.5817	Strong
580	0.7756	Strong
780	0.9695	Strong
920	1.1635	Strong
1080	1.3574	Bending point

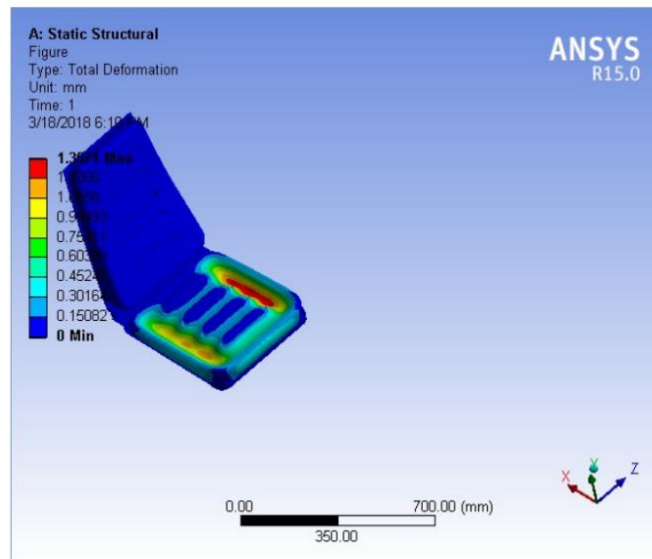


FIGURE 9
Model (A4) > Static Structural (A5) > Solution (A6) > Equivalent Elastic Strain > Figure

Fig 4. Analysis of seat when subjected to 1080 N

4.RESULTS AND DISCUSSION

From the inflation test, the air can be stored within the given seat compartment without leakage and time consumption for filling of air is about 5 minutes and removal of air is within 10 minutes. From the comfort test, the seat can provide the basic comfort as provided by normal seat. Here comfort of this seat is less compare to foam seat but it can provide necessary safety required. The load test implies that seat can withstand about 90 kg steadily and deflection about 1mm occurs when the load is 100 kg. Thus the seat can withstand 90 kg as accurate and further increase in weight will made an inverse property to bending of seat. Maximum withstand weight of seat will be 90 kg. Heat test is not carried out since the LPDE material can withstand high temperature without melting. Its melting point is about 200°C, so that in closed atmosphere of car will not affect the seat on basis of temperature.

5. CONCLUSION

The experimentation is done in static condition. The further study should be made on improving the seat comfort, seat support and advanced safety measure for seat. Investigation should be done on active air cushion by using microprocessor and control system for pressure distribution for different air cushion material. And also the frame structure has been done rigid. On upcoming, frame may be attached to flexible leg setup so that entire frame including air inflatable seats can be folded into small area like bed with foldable legs. This will lead to more interior space for cargo and goods. Thus it can be used for seating purpose if we fill this with air and can be folded to a particular area, if we need extra space for cargo.

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