

FABRICATION AND DESIGN OF A COMBINED BRAKE AND ACCELERATION PEDAL MECHANISM

**A project report submitted in partial fulfilment of the requirement for the award
of the degree of**

BACHELOR OF TECHNOLOGY

IN

MECHANICAL ENGINEERING

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CERTIFICATE

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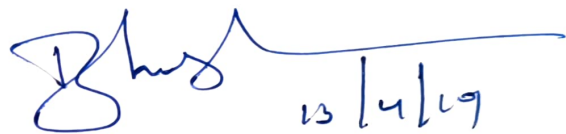
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ABSTRACT

This project deals with fabrication and design of Brake and Acceleration operated by one pedal. The main objective of this mechanism is to reduce the reaction time during shifting of foot from accelerator pedal to brake pedal and also reducing the probability of pressing the wrong pedal. The newly designed mechanism for combined accelerator and brake pedal mechanism is very simple in construction and can be easily adopted in vehicles. This type of pedal is generally adopted in electrical vehicles which operate at low speeds. At the present time automobiles are equipped with independent pedal controls for operating the accelerator and brake. These pedals being operated by right foot, and since the two functions are independent and incompatible it is necessary to leave one pedal free in order to operate the other. It is known from a survey that some drivers have difficulty in removing their foot from the accelerator pedal and transferring it to the brake pedal quickly in emergency situations. To solve this problem, a new brake pedal and accelerator system is fabricated according to conventional dimensions and designed using solid works (2016 version).

KEYWORDS: Combined pedal, Accelerator , Brake.

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CHAPTER 1

INTRODUCTION

1.1 DEFINITION OF AUTOMOBILE

An automobile is a motorized vehicle consisting of four wheels and powered by an internal engine. Automobiles are used to transport people and items from one location to another location. After years of various designs, inventors were able to develop a functional general design that is utilized by major automakers as the foundation of their designs. Automobiles generally use gasoline to fuel the internal engine, but technological advances have led to the design of cars that run on electricity and even water. The automobile can be considered to consist of five basic components :

- (a) The Engine or Power Plant : It is source of power.
- (b) The Frame and Chassis : It supports the engine, wheels, body, braking system, steering, etc.
- (c) The transmission which transmits power from the engine to the car wheels .

1.1.1 THE MAIN PARTS OF AN AUTOMOBILE ARE

- Braking system.
- Engine components and parts.
- Engine cooling system.
- Engine oil systems.
- Exhaust system.
- Fuel supply system.
- Suspension and steering systems.
- Transmission system.

Our project work mainly depends on Accelerator and Brake.

1.2 ACCELERATION

The throttle pedal is a direct line to your car's engine. It controls the airflow into the intake manifold either through a throttle body for fuel injection, or a

carburettor. This air is then mixed with fuel, fed either by a fuel rail and fuel injectors, or a carburettor, and is then introduced with spark (such as fire), fed by spark plugs.

This causes combustion, which forces the engine's pistons down to rotate the crankshaft. As the throttle pedal gets closer to the floor, the more air is sucked into the intake manifold to be mixed with even more fuel to rotate the crankshaft faster. This is your engine "revving" as the revolutions per minute (rpm) of the crankshaft increase. This is where a transmission comes into play, as it helps transform engine speed into wheel speed. Regardless of whether you have a manual or an automatic transmission, both varieties tap into the engine via an input shaft. Sandwiched between the engine and the transmission is either a clutch for manual transmissions, or a torque converter for automatics. In essence, a clutch and engages the engine from the transmission, while a torque converter maintains the connection but uses a fluidfed one-way stator and a turbine to eliminate engine stalling when idle. Think of it as a device that is constantly "slipping" the connection between the engine and the transmission. At the end of the transmission is the output shaft to rotate the driveshaft and ultimately, the tires.

1.3 BRAKING SYSTEM

A brake is a mechanical device that inhibits motion by absorbing energy from a moving system .It is used for slowing or stopping a moving vehicle, wheel, axle, or to prevent its motion, most often accomplished by means of friction. Brakes may be broadly described as using friction, pumping, or electromagnetics. One brake may use several principles.

1.3.1 EMERGENCY BRAKES

Emergency brakes, also known as parking brakes, are a secondary braking system that work independent of the service brakes. While there are many different kinds of emergency brakes (a stick lever between the driver and passenger, a third pedal, a push button or handle near the steering column, etc.), almost all emergency brakes powered by cables which mechanically apply pressure to the wheels. They are

generally used to keep a vehicle stationary while parked, but can also be used in emergency situations if the stationary brakes fail.

1.3.2 DRUM BRAKES

Drum brakes consist of a brake drum attached to the inside of the wheel. When the brake pedal contracts, hydraulic pressure presses two brake shoes against the brake drum. This creates friction and causes the vehicle to slow and stop.



Fig 1.1 DRUM BRAKES

1.3.3 ANTI-LOCK BRAKES

Anti-lock braking systems (ABS) are found on most newer vehicles. If the stationary brakes are applied suddenly, ABS prevent the wheels from locking up in order to keep the tires from skidding. This feature is especially useful when driving on wet and slippery roads.

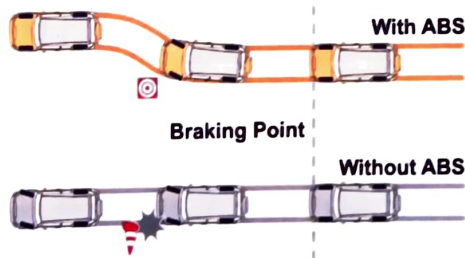


Fig 1.2 ANTI LOCK BRAKING SYSTEM

1.3.4 DISC BRAKES

A disc brake is a type of brake that uses callipers to squeeze pairs of pads against a disc or "rotor" to create friction. This action slows the rotation of a shaft, such as a vehicle axle, either to reduce its rotational speed or to hold it stationary. The energy of motion is converted into waste heat which must be dispersed. Compared to drum brakes, disc brakes offer better stopping performance because the disc is more readily cooled. As a consequence discs are less prone to the brake fade caused when brake components overheat. Disc brakes also recover more quickly from immersion (wet brakes are less effective than dry ones). The disc is usually made of cast iron, but may in some cases be made of composites such as reinforced carbon-carbon or ceramic matrix composites. This is connected to the wheel and/or the axle. To slow down the wheel, friction material in the form of brake pads, mounted on the brake calliper, is forced mechanically, hydraulically, pneumatically, or electromagnetically against both sides of the disc. Friction causes the disc and attached wheel to slow or stop.

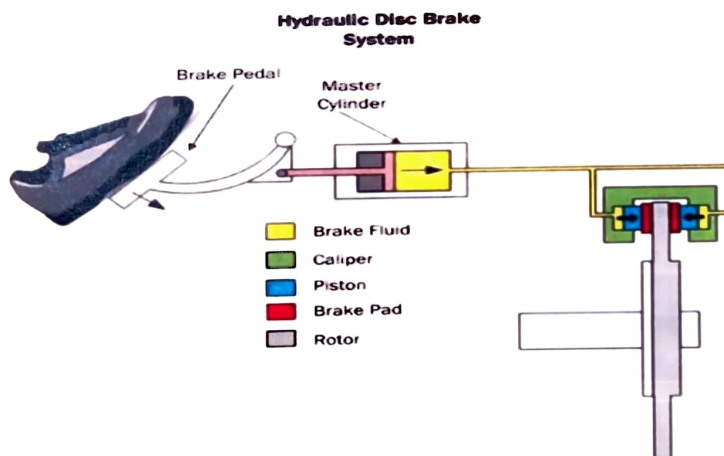


Fig 1.3 HYDRAULIC BRAKING SYSTEM

1.4 COMBINED PEDAL FOR BRAKE AND ACCELERATION

Nowadays the increment in the death rate of India is 20% because of the accidents on the highways hence this innovation can help us to reduce the death rate by 7% to 10% since this can be used in the any 4 wheeler. The innovation relates to the improvements in the mechanical movements and has a particular reference to a

Combined foot brake pedal and accelerator pedal movement. It essentially consists of a joint pedal for operating the brake and accelerator, arranged in such a form that its action to affect one or the other function is carried out without the possibility of error, and without one function interfering with the other.

As conventional pedals are equipped with separate brake and accelerator. The clutch is to the left, the accelerator to the right and the brake in the middle. The right foot should be used for pressing the accelerator and brake. The arrangement guarantees, that the throttle is released as the driver brakes.

However, it also means that the foot is almost always placed at a distance from brake, that is, on the accelerator, thus movement time adds to brake reaction time. The foot may be inaccurately placed on the brake resulting in bad braking performance and it may even miss the brake and hit the accelerator. It is being observed that it takes longer to brake in an emergency with separate pedals. It takes at least 0.2 seconds to move your foot from one pedal to other and hence, at 80 kilometres per hour this adds five meters to vehicle's stopping distance. Moreover, due to sight misjudgement it is easy to hit the wrong pedal which leads to accelerator being clipped, causing a crash.

In order to eliminate such kind of problems, A COMBINED BRAKE AND ACCELERATION PEDAL MECHANISM is designed, which can be adopted by driver quickly and effortlessly.

This new mechanism enables the driver to control acceleration and braking using one feet, which will lead to reduction in stopping distance, misjudgement.

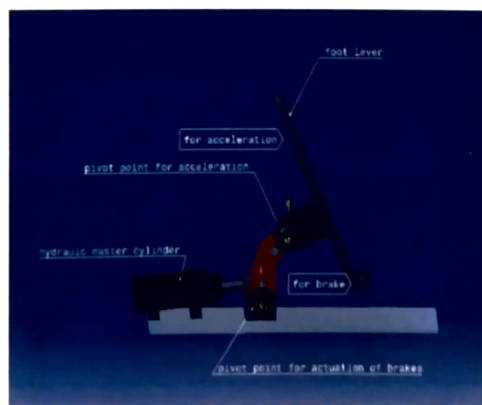


Fig 1.4 COMBINED BRAKE AND ACCELERATION PEDAL

1.5 OBJECTIVES OF PROJECT

1.5.1 Fabrication of combined brake and acceleration pedal mechanism

Fabrication of combined pedal for brake and acceleration had been done by combining the braking pedal and accelerator pedal mechanism on single pivot.

1.5.2 Modelling of combined brake and acceleration pedal mechanism

Designing of combined brake and acceleration pedal is done using SOLID WORKS (2016 version).

1.6 APPLICATIONS AND ADVANTAGES

1. All automatic transmission vehicles such as Cars, Trucks, Bus and bikes, commercial vehicles and all automotive vehicles.
2. This combined pedal mechanism thus provides a driving control which permits the quick and smooth transition from acceleration to braking, without need to transfer foot from one pedal to another.
3. This combined mechanism can be used in electric motor vehicle as they are low speed vehicles.

In this chapter we deal with automobile, its components especially brake and acceleration. The objectives and applications of our project has also been discussed. And in the next chapter literature review is discussed.

CHAPTER 2

LITERATURE REVIEW

In the process of making a new project, it is required to read an exhaustive literature review of the facts that have been suggested by various authors. Literature review was performed by collecting articles from various journals, various popular research related sites and various articles. Literature from journal papers and conference studied for combined pedal for brake and acceleration are reviewed and below of them are found to be more important for us.

[1] **K.Mugundhan, V.B.Vishal, B.Arun Prakash, M.Gowtham Raj** in their paper the problem in using standard pedal is identified that the foot may be inaccurately placed on the brake resulting in bad braking performance and it may even miss the brake and hit the accelerator. It is being observed that it takes longer to brake in an emergency with separate pedals. It takes at least 0.2 seconds to move your foot from one pedal to other and hence, at 80 kilometres per hour this adds five metres to vehicles stopping distance. Moreover, due to sight mis-judgement it is easy to hit the wrong pedal which leads to accelerate being clipped, causing a crash. From this paper we got the idea of combined pedal mechanism for brake and accelerator.

[2] **Sahil Arora** has been designed and fabricated a combined pedal for brake and acceleration. The mechanism used involves a pedal mounted at centre of a vertically displaceable pivot. The ends of the pedal serves as accelerator and brake. To accelerate driver, pivot the pedal while to brake driver, push the entire pedal mechanism forwards. So, Accelerating is feet movement and while braking comes from extending whole leg. A driver can switch from acceleration to braking instantly, just by pressing pedal forwards. We have taken their mechanism.

[3] **Swapnil Pawar, Sagar Buchade, Omkar Patil, Anis Maneri and Prof K.M.Jagadale** in their project they have mentioned the objectives for design and fabrication of combination of brake and accelerate pedal. They also designed the

model using Auto CAD and have shown the project setup with schematic representation of all components. From this paper we got complete idea of mechanism used.

[4] **Richard A. Schmidt** in their paper they mentioned about Unintended acceleration which is a review of human factors contributions. They studied about the foot movement errors that drivers make while driving. Some of the errors are Errors in response choice, Errors in response execution . This paper is completely about the analysis of the research literature in human factors, experimental psychology, and kinesiology supporting the view that these problems are caused by drivers producing foot placement errors, with some of these errors actually being observed. From this paper we got to about human errors in driving.

[5] **G.Shanmugasundar, A.Jai Krishna, M.Harish, P. Yuan shankar, R.Ambarasan, M.Muneeswaran.** in their paper they have shown the various methods for developing and optimising accelerator and brake pedal . They had also shown the importance of composites towards automotive industry and the importance of combined brake accelerator pedal system. From this we came to know how the displacement and von Mises stress vary basing on the material used for the pedal.

[6] **Adit khakhar, Karthik Rao, Siddhant satam, Farheen Bobere** they have constructed a combined pedal for brake and acceleration using base frame, pedal, spring (tensile), master cylinder, throttle body, acceleration cables, motor, pulley, wheel and tyre. The motor is connected to a 12 V dc battery, which provides the electric supply to operate the wheel in running condition and braking assembly was mounted on the frame which carries the wheel . By their experiment we came to know about the advantages and limitations of using a combined brake and acceleration pedal.

CHAPTER 3

FABRICATION OF COMBINED BRAKE AND ACCELERATION PEDAL MECHANISM

3.1 THE MAIN COMPONENTS IN COMBINED BRAKE AND ACCELERATION PEDAL

The main components used in this project are base frame, pedal, washers, spring(torsion and tensile),movable supporting plates which are attached to the tensile springs. The pedal consist of two pivot points 1 and 2. The pivot point 1 and 2 used for acceleration and braking. For acceleration pivot point 2 is used and for braking pivot point 1 is used.

3.1.1 BASE FRAME

A frame is often a structural system that supports other components of a physical construction. The frame can with stand all the other components springs supporting plates and other rods etc.. The frame should have the maximum load withstand capacity. The frame is joined by using arc welding.

3.1.2 TENSILE AND TORSION SPRING

A spring is a flexible elastic object used to store mechanical energy. Torsion spring is a spring that works by torsion or twisting. It is used for automatic retrieving of pedal during acceleration (Feet Moment) Tensile spring is used for braking (Leg Moment).

3.1.3 PEDAL

In this project we can use single pedal for braking and acceleration to quickly stop the vehicle. The pedal is joined by using arc welding. A combined and pedal mechanism is designed to function as both brake and accelerator, which can be adopted by driver quickly and effortlessly. This new mechanism enables the driver to control acceleration and braking using one feet, which will lead to reduction in stopping distance, misjudgement and ultimately decrease in number of road accidents that may happen each day.

3.2 MATERIAL SELECTION

The proper selection of material for the different part of a machine is the main objective in the fabrication. The Choice of material for engineering purposes depends upon the following factors:

1. Availability of the materials.
2. Suitability of materials for the working condition in service.
3. The cost of materials.
4. Physical and chemical properties of material.
5. Mechanical properties of material.

The combined pedal is made up of mild steel in our present work.

3.3 PROPERTIES OF MILD STEEL

- Mild steel has carbon content from 0.15% to 0.30%.
- Both ultimate tensile and compressive strength of steel increases with increasing carbon content.
- They can be easily gas welded or electric or arc welded.
- With increase in the carbon percentage weldability decreases.

3.4 MACHINING PROCESS

In order to fabricate the pedal with combined brake and acceleration the following machining processes are done.

3.4.1 PORTABLE DRILLING MACHINE

Portable drilling machines are the most common type in use today, and are available in a huge variety of subtypes. A less common type is the right-angle drill, a special tool used by tradesmen such as plumbers and electricians. The motor used in corded drills is often a universal motor due to its high power to weight ratio Clamped in position and the drill rotates to make a hole disc itself (circular diamond blade for disc cutter vs. abrasive grinding wheel for angle grinder).



Fig 3.1 PORTABLE DRILLING MACHINE

3.4.2 BUFFING

Buffing is a finishing process for smoothing a work piece's surface using an abrasive and a work wheel or a leather strop. Technically polishing refers to processes that use an abrasive that is glued to the work wheel, while buffing uses a loose abrasive applied to the work wheel.



Fig 3.2 BUFFING MACHINE

3.4.3 WELDING

Welding is the process where a short of current generated and a spark with high heat produced and it melts the electrode and form as a liquid substance and by natural air it cools down and metals join furtherly. Welding is basically used to join

two sheets with variable thickness and by using additional features like electrodes helps to form the material melt.



Fig 3.3 WELDING MACHINE

3.4.4 SURFACE FINISHING

Polishing and buffing are finishing processes for smoothing a work piece's surface using an abrasive and a work wheel. Polishing is a more aggressive process while buffing is less harsh, which leads to a smoother, brighter finish.

3.5 FABRICATED MODEL



Fig 3.4 FABRICATED MODEL

The working of the fabricated model is tested by fixing it to the GO KART
 Below tables 3.1 and 3.2 shows vehicle i.e GOKART specifications and considerations.

3.6 VEHICLE SPECIFICATIONS

VEHICLE MAKE MODEL	VALUE	VEHICLE MAKE MODEL	VALUE
Wheel Base	49in	Engine & Transmission	208 cc, Centrifugal Clutch
Track Width	Front:40in Rear:42in	Engine max. Torque	9.75 Nm
Overall Length	72in	Steering	Ackerman
Overall Width	48in	Turning radius	3.2m
Ground clearance	2in	Maximum Speed	66 kmph
Overall Weight	125 Kg	Brake	Disc Brake
Material	AISI-4130	Tire size	10in diameter

TABLE 3.1 VEHICLE SPECIFICATIONS

3.7 VEHICLE CONSIDERATIONS

	Priority	Reason
Simplicity	High	Overall goal of vehicle
Performance	High	Capable of stopping vehicle
Lightweight	High	Prevent air bubble within the brake lines
Reliability	Essential	Lightweight parts to minimize total weight
Ergonomics	Essential	Optimal pedal assembly fitment to suit every driver

TABLE 3.2 VEHICLE CONSIDERATIONS

3.8 BRAKING SYSTEM OF THE VEHICLE

The purpose of the brakes is to stop the car safely and effectively. In order to achieve maximum performance from the braking system, the brakes have been designed to lock up rear wheels, while minimizing the cost and weight.

The brake system design includes the single disc at the rear axle to stop the vehicle. It is mounted in the one third part position of the axle. Master cylinder is used at the front near the brake pedal providing the occupant to easily accessible space. A proper master cylinder bore size was found by doing brake calculations based on the mass, centre of gravity, master cylinder volume size, and various dimensions of the vehicle. Though braking power increased with a decrease in bore size, the volume of brake fluid that was able to be displaced decreased with decreasing bore size.

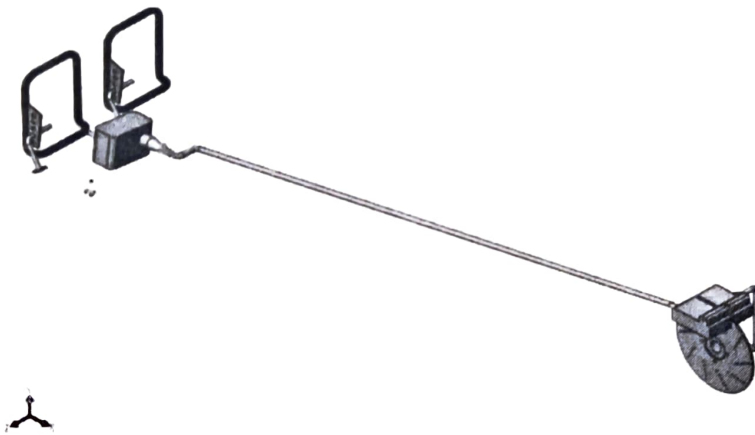


Fig 3.5 COMPLETE BRAKE LINE ASSEMBLY OF THE VEHICLE

3.9 WORKING OF MECHANISM

Working mechanism i.e position of foot for no brake and acceleration, only brake, only acceleration has been discussed.

3.9.1 NEITHER ACCELERATION NOR BRAKING

In this condition foot of a driver simply rests on foot lever, it does not cause either of the function. Fig 3.6 shows the positioning of foot , any further movement results in acceleration or braking.

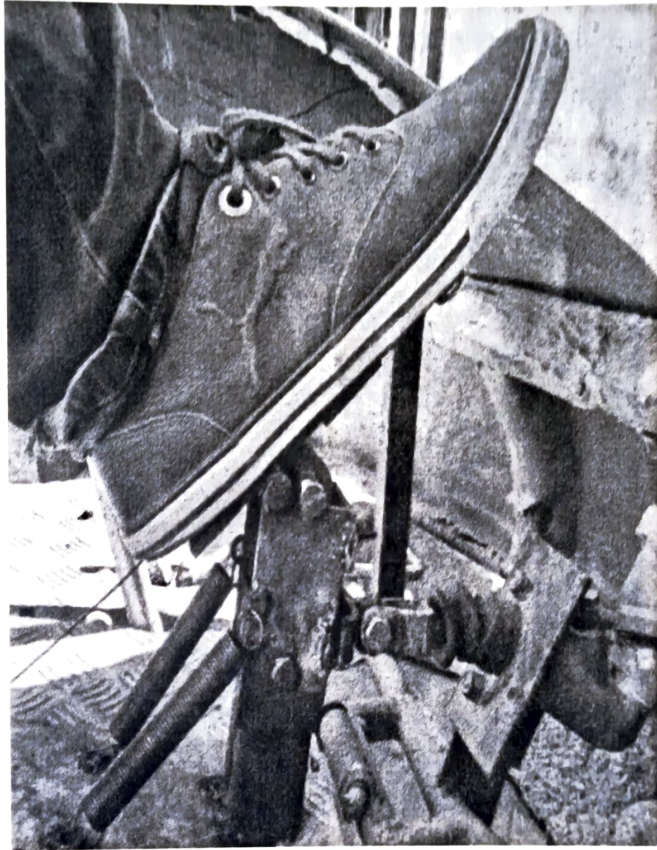


Fig 3.6 DURING NEITHER ACCELERATION NOR BRAKING

3.9.2 ACCELERATION

In order to accelerate, the foot lever rotates about pivot point 2 (upper pivot point), Figure 3.6 shows the upper half of foot lever moves in downward direction and lower half of pedal moves in upward direction i.e rotation of foot lever would be in anticlockwise direction. However, the support is kept in stationary position, this

resistance is achieved by using helical tension spring. The main purpose of spring is to provide Resisting force to the support during throttling. Hence, by using upper half of the foot, driver can accelerate the vehicle without actuation of brakes.



Fig 3.7 ACCELERATION POSITION

3.9.3 BRAKING

In order to brake, the foot lever and support both moves in linear direction such that, there would be no acceleration of the vehicle. This is achieved by fixing the source (acceleration cable) at the bottom end of the pedal near the heel rest. Therefore, the whole assembly (foot lever, support) rotates about the pivot point 1 and spring

comes in stretched position. On releasing the pedal, the spring tends to come in original position due to spring action. Hence, driver can decelerate or stop the vehicle without actuation of throttle.

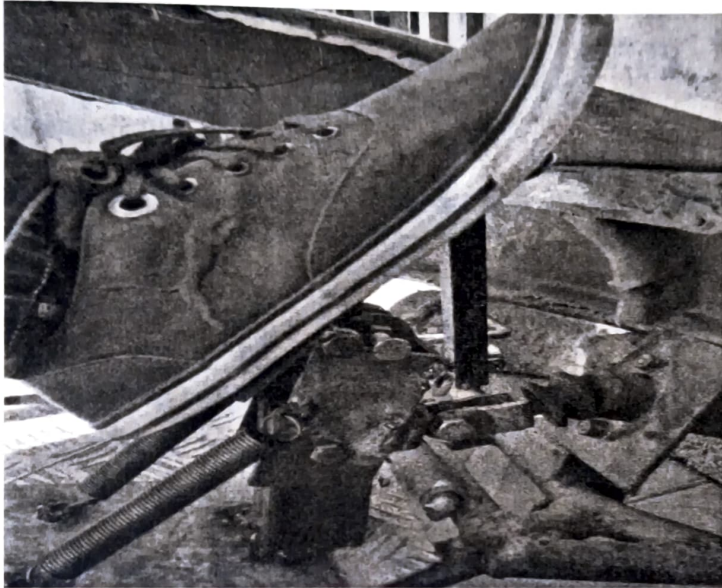


Fig 3.7 BRAKING POSITION

Next chapter deals with the calculations for brake torque and force ,DOF for the combined brake and acceleration pedal mechanism.

CHAPTER 4

CALCULATIONS FOR COMBINED BRAKE AND ACCELERATION PEDAL MECHANISM

4.1 PEDAL MECHANISM:

The combined brake and acceleration pedal mechanism is shown in block diagram.

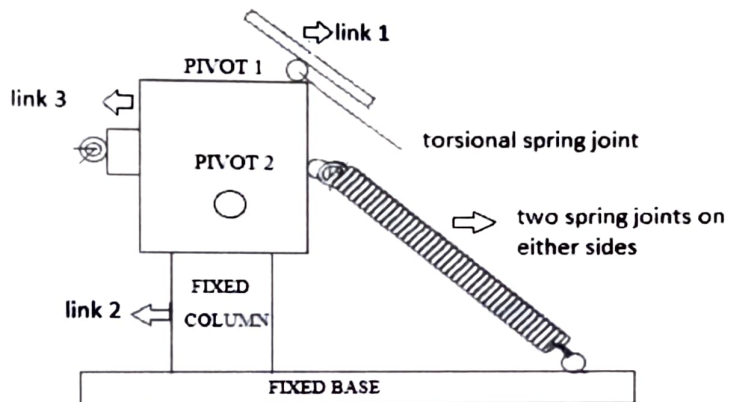


Fig 4.1 BLOCK DIAGRAM

The system contains two pivot points 1 and 2 and two helical springs to bring back the system to its original position after braking has been done. It also consists of one torsional spring to retrace the pedal motion back to its original position after the acceleration has been performed.

When the pedal force is applied such that the pedal rotates about the pivot point 1 the acceleration of the vehicle takes place.

When the pedal force is applied such that rotation takes place about the pivot point 2, brake is applied to the vehicle and the vehicle stops.

4.2 DEGREES OF FREEDOM:

From the block diagram the links and joints are found to be:

No of links $L=3$.

No of spring joints $J_s=3$.

Each spring joint can be considered as two binary links .

No of spring links $L_s=6$.

No of joints $J=8$.

To calculate the degrees of freedom of the mechanism we have formula

$$\begin{aligned} N &= 3(L + L_s - 1) - 2(J_s + J) \\ &= 3(3 + 6 - 1) - 2(3 + 8) \\ &= 24 - 22 \\ &= 2 \end{aligned}$$

So the degrees of freedom of the present mechanism is 2. One is for the movement of the acceleration and other is rotation for braking of the system.

4.3 FREE BODY DIAGRAM OF MECHANISM:

The various forces acting on the combined pedal mechanism are shown in the following Fig 4.2

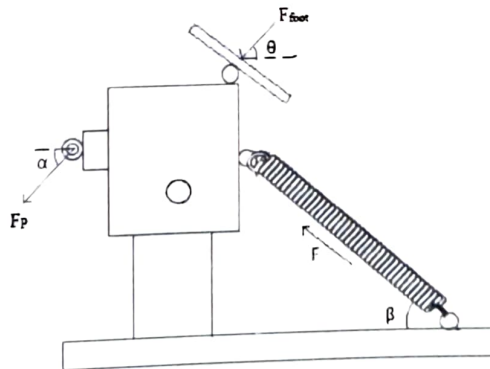


Fig 4.2 FREE BODY DIAGRAM OF MECHANISM

Here there are three forces acting on the pedal.

F - The force due to the spring that is acting on the pedal which restores the movement of the pedal .

F_P - Force that is acting on the piston of the master cylinder.

F_{FOOT} - Force that is given as a input pedal force on the pedal.

=20kgF as per human foot.

Now resolving the forces along horizontal and vertical directions .

1. When the force F is resolved :

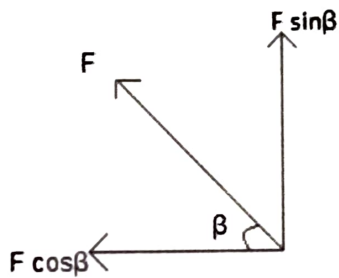


Fig 4.3 RESOLVING F

Horizontal component = $-F \cos\beta$

vertical component = $F \sin\beta$ From

measurements $\beta = 55$ degrees

2. When the force F_P is resolved:

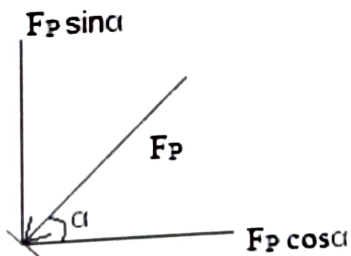


Fig 4.4 RESOLVING F_P

Horizontal component = $-F_P \cos \alpha$

vertical component = $-F_P \sin \alpha$ From

measurements $\alpha = 55$ degrees

3. When the force F_{FOOT} is resolved:

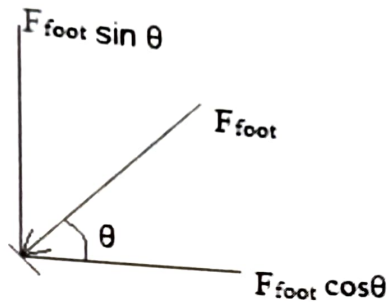


Fig 4.5 RESOLVING F_{FOOT}

(since $F_{\text{FOOT}} = 20 \text{Kg F}$)

Horizontal component = $-(20 \times 9.81) \cos \theta$

Vertical component = $-(20 \times 9.81) \sin \theta$

From measurements $\theta = 45$ degrees

Now according to law of equilibrium of forces,

We have sum of horizontal forces = 0

sum of vertical forces = 0 Horizontal forces:

$$(20 \times 9.81) \cos(45) + F_P \cos(50) + F \cos(55) = 0$$

$$103.06 + F_P(0.64) + F(0.573) = 0 \text{ -----(1)}$$

Vertical forces:

$$F_P \sin(50) + (20 \times 9.81) \sin(45) + F \sin(55) = 0$$

$$F_P(0.766) + 166.94 - F(0.819) = 0 \text{ -----(2)}$$

Solving equations (1) and (2)

We get $F_P = 186.9 \text{ N}$

$$F = 28.9 \text{ N}$$

4.4 BRAKE TORQUE AND FORCE CALCULATIONS

For calculation of brake torque and force, the inputs have been taken from previous work of GO KART, which are as follows:

Diameter of master cylinder = 15mm

Diameter of calliper = 25 mm

Hydraulic pressure = Force/area

As Hydraulic pressure at calliper = Hydraulic pressure at cylinder.

P_1 = pressure at master cylinder.

P_2 = pressure at calliper.

By equating the pressures we have $P_1 = P_2$

$$F_1/A_1 = F_2/A_2. \text{ -----(3)}$$

Where A_1 = Area of master cylinder

$$= 3.14/4 * (15 * 15) \text{ mm}$$

$$= 176.625 \text{ mm}^2$$

A_2 = Area of calliper cylinder

$$= 3.14/4 * (25 * 25) \text{ mm}$$

$$= 490.625 \text{ mm}^2$$

We know that $F_1 = F_p$ = Force at master cylinder (From Bernoullis principle) = 186.9N

From equation (3) we have

$$F_2 = F_1/A_1 * A_2$$

$$= (186.9/176.625) * 490.625$$

$$= 519.16 \text{ N}$$

Since the calliper is double acting now the force obtained is = $2 * F_2$

$$= 2 * 519.16$$

$$= 1038.32 \text{ N}$$

Braking torque = force on disc * radius of the brake disc

Force on the disc = 1038.32 N

Radius of the disc = 90 mm (from GOKART)

Braking torque = $1038.32 * 90 / 1000$

$$= 93.44 \text{ N}$$

Now this disc is mounted on the axle of the go kart which rotates along with axle.

As Braking torque = braking force * radius of the tyre.

Radius of tyre = 0.127m (from GOKART)

Now brake force = braking torque / radius.

$$= 93.44 / 0.127$$

$$= 735.81 \text{ N}$$

We have Force = mass * acceleration Mass

of the gokart is considered to be 140kg

Now Acceleration = Force/mass.

$$= 735.81 / 140$$

$$= 5.255 \text{ m/sec}^2$$

From equations of motion we have

$$V^2 - U^2 = 2 * a * S,$$

$$V = U + a * t$$

$$S = U * t + 0.5 * a * t^2.$$

Where V- Final velocity

U-Initial velocity

S-Distance Travelled

t-time

a-acceleration

4.5 CALCULATION FOR STOPPING DISTANCE:

Let us consider stops after moving a distance s . final velocity $V=0$.

Acceleration $a=5.255 \text{ m/sec}^2$.

We have

$$V^2-U^2= 2*a*S$$

$$\text{Now } S= U^2/10.51$$

Here negative value indicates deceleration of the vehicle so it is not considered.

Consider various speeds of vehicles

When $U= 20\text{kmph} =5.55\text{m/s}$

$$S= 5.55^2/10.51$$

$$=2.93\text{m}$$

When $U= 30\text{kmph} =8.33\text{m/s}$

$$S = 8.33^2/10.51$$

$$=6.602\text{m}$$

When $U= 35\text{kmph} =9.721\text{m/s}$

$$S= 9.721^2/10.51$$

$$=8.991\text{m}$$

4.6 CALCULATION OF STOPPING TIME:

As $V=U +a*t$. Here

final velocity $V=0$ $t=-$

(U/a) .

Here negative value indicates deceleration of the vehicle so it is not considered. Now

when $U= 20\text{kmph} =5.55\text{m/s}$

$t=5.55/10.51$

$= 0.52$ sec

when $U= 30\text{kmph} =8.33\text{m/s}$ t

$=8.33/10.51$

$= 0.792$ sec when $U=$

$35\text{kmph} =9.722\text{m/s}$ t

$=9.722/10.51$

$= 0.925$ sec

when $u= 20\text{kmph}$

$U=5.55\text{m/s}$ $T=5.55/11.24$

$= 0.493$ sec

The next chapter is on design of combined brake and acceleration pedal mechanism

CHAPTER 5

DESIGN OF COMBINED BRAKE AND ACCELERATION PEDAL MECHANISM

In this present work the designing of combined brake and acceleration pedal mechanism is done using solid works (2016 Version).

5.1 INTRODUCTION TO SOLID WORKS:

SOLIDWORKS is a mechanical design automation software package used to build parts, assemblies and drawings that takes advantage of the familiar Microsoft Windows graphical user interface.

SOLIDWORKS is an easy to learn design and analysis tool (SOLIDWORKS Simulation, SOLIDWORKS Motion, SOLIDWORKS Flow Simulation, Sustainability, etc.), which makes it possible for designers to quickly sketch 2D and 3D concepts, create 3D parts and assemblies and detail 2D drawings.

Model dimensions in SOLIDWORKS are associative between parts, assemblies and drawings. Reference dimensions are one-way associative from the part to the drawing or from the part to the assembly.

The book is written for the beginner user with six or more months of experience to the intermediate user and assumes that you have some working knowledge of an earlier version of SOLIDWORKS.

5.2 MENU TOOLBAR:

The SOLIDWORKS 2016 (UI) is designed to make maximum use of the Graphics window. The Menu Bar toolbar contains a set of the most frequently used tool buttons from the Standard toolbar. The available default tools are:

- New - Creates a new document.
- Open - Opens an existing document.

- Save - Saves an active document.
- Print - Prints an active document.
- Undo - Reverses the last action.
- Select - Selects Sketch entities, components and more.
- Rebuild - Rebuilds the active part, assembly or drawing.
- File Properties - Shows the summary information on the active document.
- Options - Changes system options and Add-Ins for SOLIDWORKS.

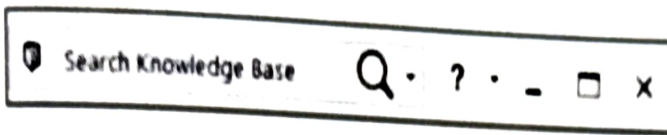


Fig 5.1 MENU TOOL BAR

5.3 MENU BAR MENU:

Click SOLIDWORKS in the Menu Bar toolbar to display the Menu Bar menu. SOLIDWORKS provides a context-sensitive menu structure. The menu titles remain the same for all three types of documents, but the menu items change depending on which type of document is active.



Fig 5.2 MENU BAR MENU

Example: The Insert menu includes features in part documents, mates in assembly documents, and drawing views in drawing documents. The display of the menu is also dependent on the workflow customization that you have selected. The default menu items for an active document are File, Edit, View, Insert, Tools, Window, Help and Pin.



Fig 5.3 DEFAULT MENU BAR MENU

The Pin option displays the Menu bar toolbar and the Menu bar menu as illustrated. Throughout the book, the Menu bar menu and the Menu bar toolbar are referred to as the Menu bar.

5.4 DROP DOWN MENU:

SOLIDWORKS takes advantage of the familiar Microsoft® Windows user interface. Communicate with SOLIDWORKS through drop-down menus, Context sensitive toolbars, Consolidated toolbars or the Command Manager tabs.

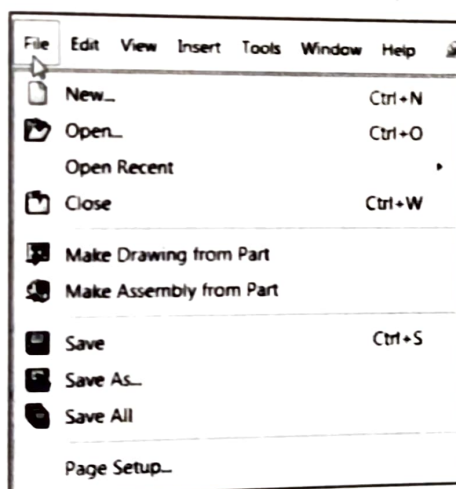


Fig 5.4 DROP DOWN MENU

A command is an instruction that informs SOLIDWORKS to perform a task.

To close a SOLIDWORKS drop-down menu, press the Esc key. You can also click any other part of the SOLIDWORKS Graphics window or click another drop-down menu.

5.5 SOLIDWORKS 2016 NEW ICON STYLE₁

SOLIDWORKS 2016 provides a new icon style. It allows vector based scaling for superior support of high resolution, high pixel density displays. The new icon style standardized the perspective of icons, removes non-essential details, and emphasizes primary elements. Consistent visual styling applies to all icons.

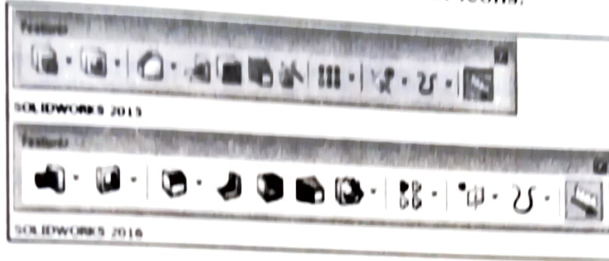


Fig 5.5 SOLIDWORKS NEW ICON STYLE

5.6 ADDITIONAL USER INTERFACE TOOLS:

The book utilizes additional areas of the SOLIDWORKS User Interface.

Explore an overview of these tools in the next section.

5.7 RIGHT CLICK:

Right-click in the Graphics window on a model, or in the Feature Manager on a feature or sketch to display the Context sensitive toolbar. If you are in the middle of a command, this toolbar displays a list of options specifically related to that command.

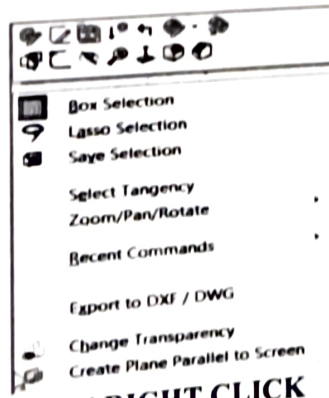


Fig 5.6 RIGHT CLICK

Right-click an empty space in the Graphics window of a part or assembly, and a selection context toolbar above the shortcut menu is displayed. This provides easy access to the most commonly used selection tools.

5.8 CONSOLIDATED TOOLBAR:

Similar commands are grouped together in the Command Manager. Example: Variations of the Rectangle sketch tool are grouped in a single fly-out button as illustrated.

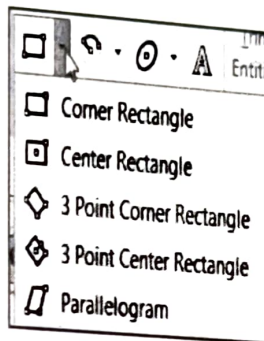


Fig 5.7 CONSOLIDATED TOOLBAR

If you select the Consolidated toolbar button without expanding:

For some commands such as Sketch, the most commonly used command is performed. This command is the first listed and the command shown on the button.

For commands such as rectangle, where you may want to repeatedly create the same variant of the rectangle, the last used command is performed. This is the highlighted command when the Consolidated toolbar is expanded.

5.9 SYSTEM FEEDBACK ICON:

SOLIDWORKS provides system feedback by attaching a symbol to the mouse pointer cursor.

The system feedback symbol indicates what you are selecting or what the system is expecting you to select.

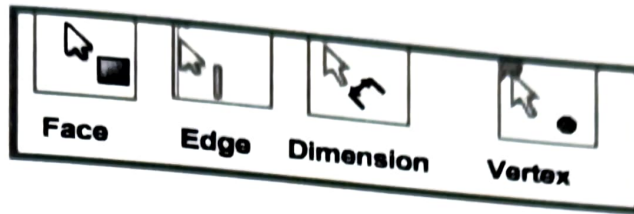


Fig 5.8 SYSTEM FEEDBACK ICON

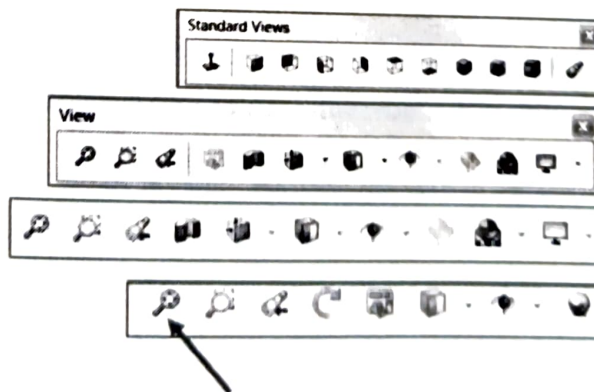
As you move the mouse pointer across your model, system feedback is displayed in the form of a symbol, riding next to the cursor as illustrated. This is a valuable feature in SOLIDWORKS.

5.10 HEADS-UP VIEW TOOLBAR:

SOLIDWORKS provides the user with numerous view options from the Standard Views, View and Heads-up View toolbar.

The Heads-up View toolbar is a transparent toolbar that is displayed in the Graphics window when a document is active.

You can hide, move or modify the Heads-up View toolbar. To modify the Heads-up View toolbar, right-click on a tool and select or deselect the tools that you want to display.



For a Drawing document

Fig 5.9 HEADS UP VIEW TOOL BAR

The following views are available: Note: The available views are document dependent.

- Zoom to Fit : Zooms the model to fit the Graphics window.
- Zoom to Area : Zooms to the areas you select with a bounding box.
- Previous View : Displays the previous view
- Section View : Displays a cutaway of a part or assembly, using one or more cross section planes.

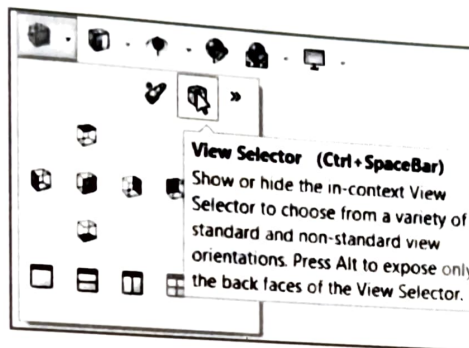


Fig 5.10 VIEWS SELECTOR

The Orientation dialog has an option to display a view cube (in-context View Selector) with a live model preview. This helps the user to understand how each standard view orientates the model. With the view cube, you can access additional standard views. The views are easy to understand and they can be accessed simply by selecting a face on the cube.

To activate the Orientation dialog box, press (Ctrl + spacebar) or click the View Orientation icon from the Heads up View toolbar. The active model is displayed in the View Selector in an Isometric orientation (default view).

As you hover over the buttons in the Orientation dialog box, the corresponding faces dynamically highlight in the View Selector. Select a view in the View Selector or click the view from the Orientation dialog box. The Orientation dialog box closes and the model rotates to the selected view.

- Click the View Selector icon in the Orientation dialog box to show or hide the in-context View Selector.
- Press Ctrl + spacebar to activate the View

- Press the spacebar to activate the Orientation dialog box.

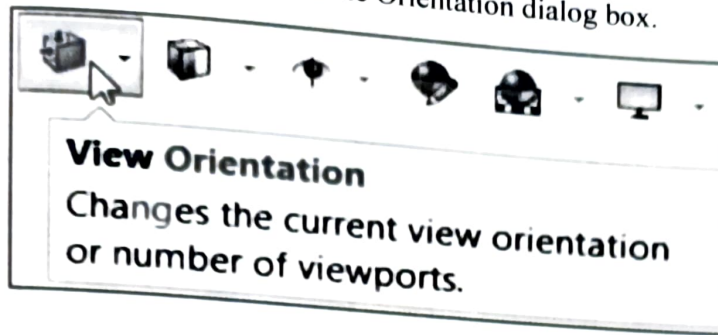


Fig 5.11 VIEW ORIENTATION

- View Orientation box : Provides the ability to select a view orientation or the number of viewports. The available options are Top, Left, Front, Right, Back, Bottom, Single view, Two view - Horizontal, Two view - Vertical, Four view. Click the drop-down arrow to access Axonometric views: Isometric, Dimetric and Trimetric.

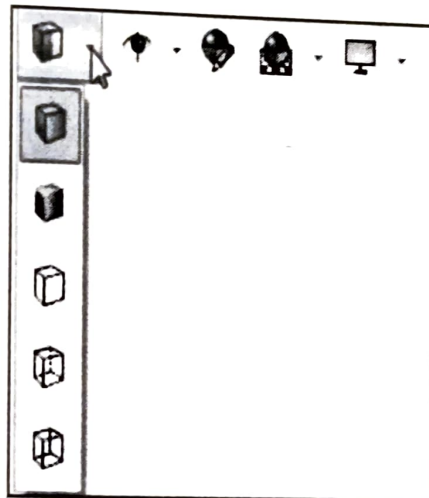


Fig 5.12 VIEW ORIENTATION BOX

- Display Style : Provides the ability to display the style for the active view. The available options are Wireframe, Hidden Lines Visible, Hidden Lines Removed, Shaded, Shaded With Edges.

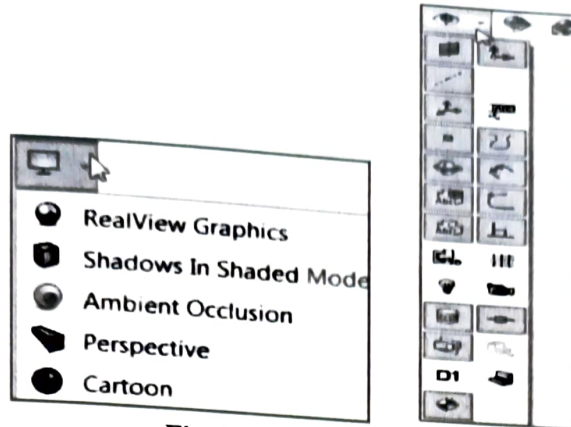


Fig 5.13 DISPLAY STYLE

- **Hide/Show Items** : Provides the ability to select items to hide or show in the Graphics window. The available items are document dependent. Note the View centre of Mass icon.
- **Edit Appearance** : Provides the ability to edit the appearance of entities of the model.
- **Apply Scene** : Provides the ability to apply a scene to an active part or assembly document. View the available options.
- **View Setting** : Provides the ability to select the following settings: Real View Graphics, Shadows In Shaded Mode, Ambient Occlusion, Perspective and Cartoon.

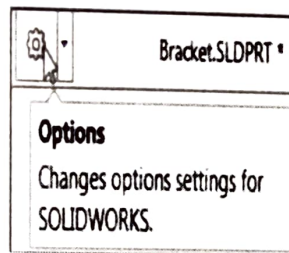


Fig 5.14 OPTIONS

- **Rotate view** : Provides the ability to rotate a drawing view. Input Drawing view angle and select the ability to update and rotate centre marks with view.
- **3D Drawing View** : Provides the ability to dynamically manipulate the drawing view in 3D to make a selection.

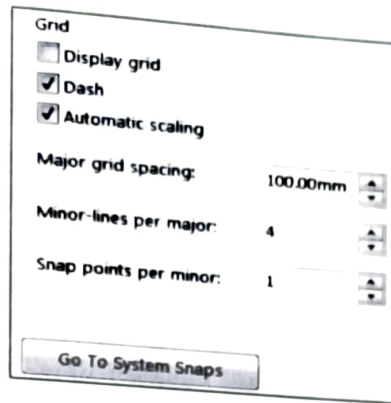


Fig 5.15 GRID

- To display a grid for a part, click Options, Document Properties tab. Click Grid/Snaps, check the Display grid box.
- Add a custom view to the Heads-up View toolbar. Press the space key. The Orientation dialog box is displayed. Click the New View tool. The Name View dialog box is displayed. Enter a new named view. Click OK.

5.11 SELECTION ENHANCEMENTS:

Right-click an empty space in the Graphics window of a part or assembly, and a selection context toolbar above the shortcut menu provides easy access to the most commonly used selection tools.

- **Box Selection.** Provides the ability to select entities in parts, assemblies, and drawings by dragging a selection box with the pointer.
- **Lasso Selection.** Provides the ability to select entities by drawing a lasso around the entities.
- **Selection Filters.** Displays a list of selection filter commands.
- **Previous Selection.** Re-selects the last entities you selected. Only available if you made a selection during this editing session.
- **Select Other.** Displays the Select Other dialog box.
- **Select.** Displays a list of selection commands.

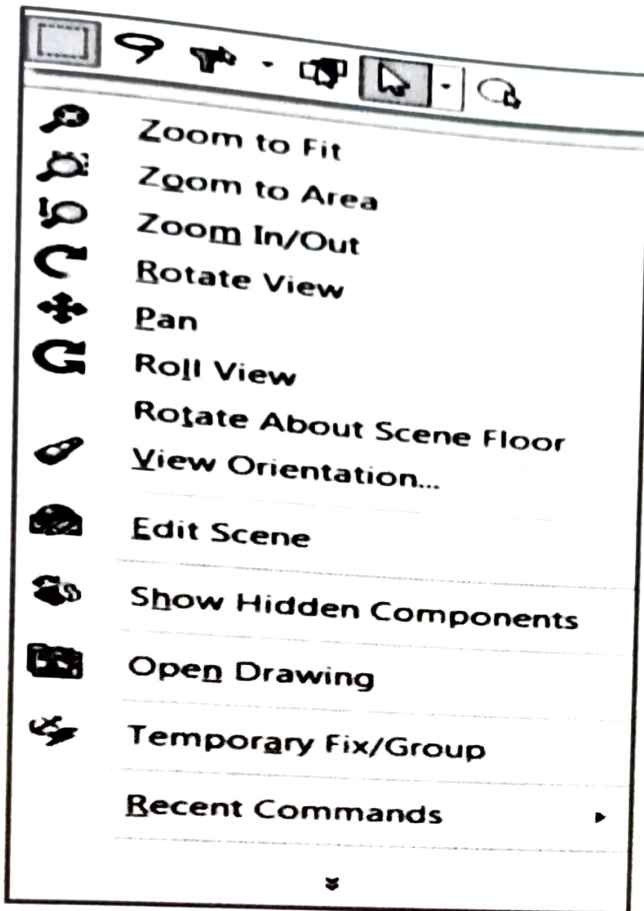


Fig 5.16 SELECTION ENHANCEMENTS

- Magnified Selection. Displays the magnifying glass, which gives you a magnified view of a section of a model.

- Save space in the Command Manager, right click in the Command Manager and un-check the Use Large Buttons with Text box. This eliminates the text associated with the tool.
- DimXpert provides the ability to graphically check if the model is fully dimensioned and toleranced. DimXpert automatically recognizes manufacturing features. Manufacturing features are not SOLIDWORKS features. Manufacturing features are defined in 1.1.12 of the ASME Y14.5M1994 Dimensioning and Tolerancing standard. See SOLIDWORKS Help for additional information.

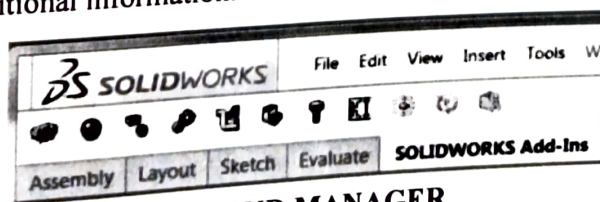


Fig 5.17 COMMAND MANAGER

5.12 TASK PLANE:

The Task Pane is displayed when a SOLIDWORKS session starts. The Task Pane can be displayed in the following states: visible or hidden, expanded or collapsed, pinned or unpinned, docked or floating.

The Task Pane contains the following default tabs:

- SOLIDWORKS Resources .
- Design Library
- File Explorer
- View Palette
- Appearances, Scenes and Decals
- Custom Properties
- SOLIDWORKS Forum

Additional tabs are displayed with Add-Ins. Use the Back and Forward buttons in the Design Library tab and the Appearances, Scenes, and Decals tab of the Task Pane to navigate in folders.



Fig 5.18 TASK PLANE

5.13 SYSTEM REQUIREMENTS:

Before installing SOLID WORKS 2016, you must have the following prerequisites for each machine.

- A SOLID WORKS 2016 visualize serial number.
- A SOLID WORKS 2016 visualize boost serial number.

The following are the system requirements to ensure the smooth running of SOLID WORKS 2016 on your system.

- Windows 7 or newer (64 bit)
- Dual core CPU; Quad core recommended • 8GB RAM; 16GB recommended
- 2GB free disk space; 5GB recommended
- 2GB or more GPU RAM; 4GB recommended
- NVIDIA graphics card: NVIDIA Quadro / NVIDIA GeForce / Tesla with atleast NVIDIA Kepler chip; Dual-GPU setup with atleast NVIDIA Maxwell cards for the best experience
- NVIDIA driver version 385.41 (or newer) recommended
- NVIDIA driver support for CUDA 9.0 or newer required
- HDR Light Studio connection: HDR Light Studio v5.3.3 or newer, except v5.4
- 4GB of video memory or more required for the Denoiser feature

5.14 DESIGN OF VARIOUS ELEMENTS OF MECHANISM:

The various components that are present in the mechanism are already discussed in chapter 3, the following are the design components shown

5.14.1 BASE PLATE:

LENGTH : 18 cm

WIDTH : 10.3 cm

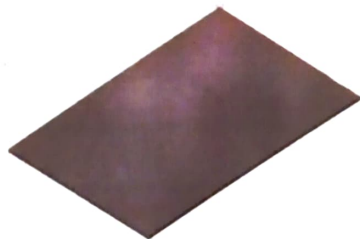
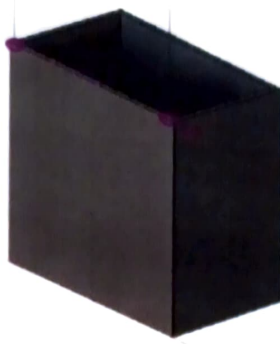


Fig 5.19 BASE PLATE

5.14.2 CENTRE PART:**Fig 5.20 CENTRE PART**

LENGTH: 5.5 cm

WIDTH: 4.8 cm

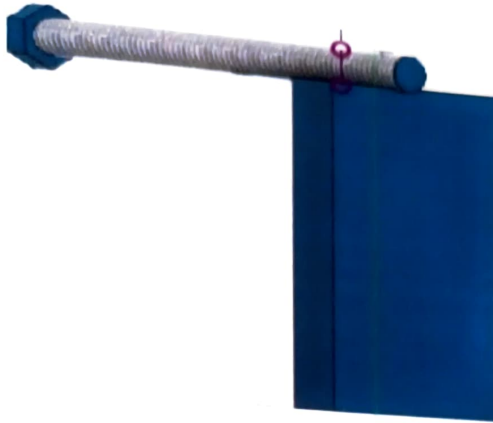
HEIGHT: 9.8 cm

5.14.3 CENTRE SHAFT:**Fig 5.21 CENTRE SHAFT**

LENGTH :4.3 cm

WIDTH: 4 cm

HEIGHT: 10.3 cm

5.14.4 CENTRE SHAFT AND SCREW:**Fig 5.22 CENTRE SHAFT AND SCREW**

SCREW LENGTH :7.5 cm

DISTANCE OF SCREW FROM EDGE: 2.3cm

5.14.5 PEDAL:**Fig 5.23 PEDAL**

LENGTH: 17.2 cm

WIDTH: 5.2 cm

5.14.6 HELICAL SPRING:**Fig 5.24 HELICAL SPRING**

LENGTH :10.3 cm

OUTER DIAMETER:1.8cm

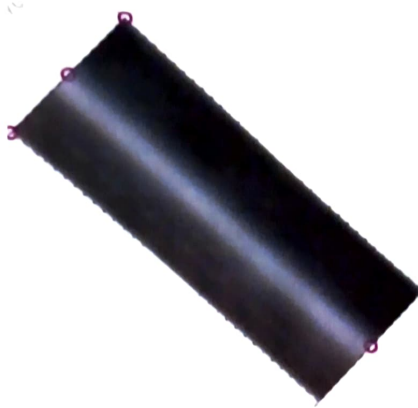
INNER DIAMETER: 1.5 cm

5.14.7 TORSION SPRING:**Fig 5.25 TORSION SPRING**

LENGTH:1.2 cm

INNER DIAMETER: 2.2 cm

OUTER DIAMETER: 2.5cm

5.14.8 SUPPORT:**Fig 5.26 SUPPORT**

LENGTH :4 cm

OUTER DIAMETER: 1.7 cm

INNER DIAMETER :1.3 cm

5.15 ASSEMBLED MODEL:

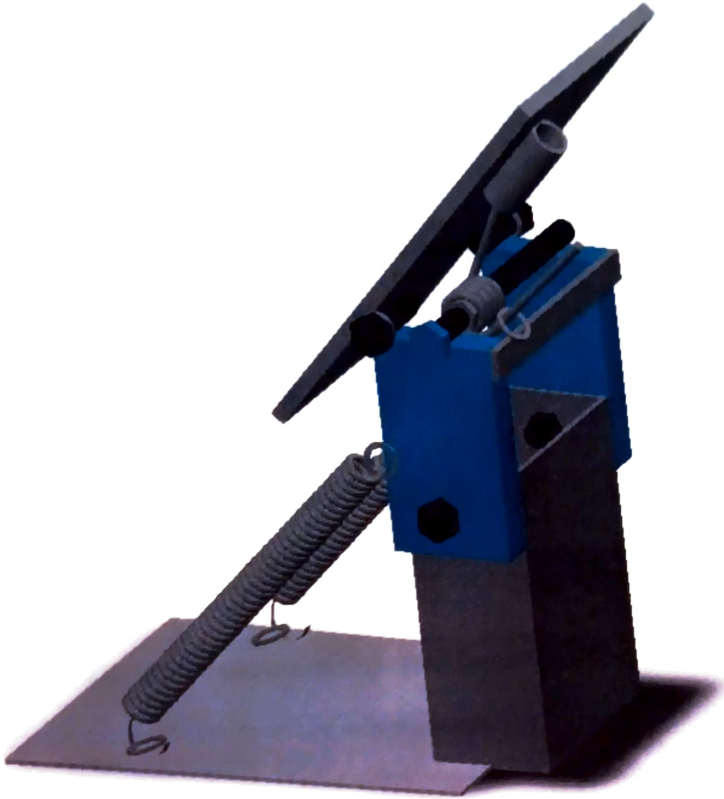


Fig 5.27 ASSEMBLED MODEL

Constraints of the model-

The base plate is fixed to the base plate of the go-kart.

The centre shaft is fixed to the base plate which has no relative movement.

The second shaft has rotational motion with respect to the fixed shaft.

The pedal has rotational motion with respect to the screw welded to the centre shaft.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

By this project we can conclude that this new mechanism results in avoiding interference of braking during acceleration and vice versa. Moreover, it is advantageous over conventional pedals. This combined pedal mechanism thus provides a driving control which permits the quick and smooth transition from acceleration to braking, without need to transfer the foot from one pedal to another. In this present work the working mechanism is described in detail and designing of this mechanism is also done using SOLID WORKS(2016 Version). As there is rapid increase in number of vehicles on roads day by day so it demands an exploration of such mechanism to get rid of driver's effort and reduce road accidents.

The future scope for this project may involve developing the basic mechanism by using sensors to improve its performance to develop and optimize in order to making into practice.

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