

## Design and Analysis of Automobile Pedal with Combined Brake and Accelerator

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**Abstract:** The Automotive vehicle has become one of modern Society's deadliest killers, in addition to injuring thousands of lives every year. Nowadays the increment in the death rate of India is 20% because of the accidents on the highways. It is mainly due to the delay in the foot movement between the brake and accelerator pedals. Hence we have 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. It is being observed that it takes longer to brake in an emergency with separate pedals. Reaction time, from onset of an accident stimulus until the brakes are initially applied, is 0.256 seconds with this one pedal system, versus 0.468 seconds under the conventional two pedal accelerator-brake systems. This saving of over 45 per cent in reaction time, results in the brakes of a vehicle being applied about 19 feet earlier at 60 mph for example. In addition, the driver would have this much more room to swerve and possibly avoid an otherwise serious situation ahead.

**Keywords** – Automotive, brakes, clutches, accidents, single pedal, reaction time

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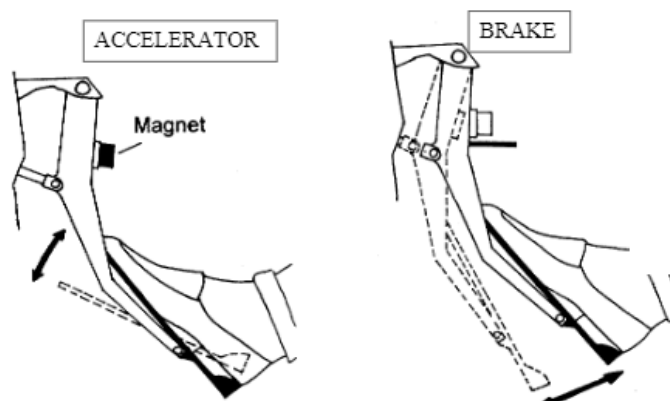
### I. INTRODUCTION

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. As conventional pedals are equipped with separate brake and accelerator such that 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. 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 kilometers per hour this adds five meters to vehicle's stopping distance. Hence, We have made an improvement by combining the 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.

### II. MOTIVATION OF THE WORK

Ajinkya Bhonge et al.,(2016) involved in a development process of pedal that has been carried to replace the existing Standard pedal for various benefits and observed that their weight reduction of due to use of aluminium alloy 7075.

Rickard Nilsson et al.,(2002) conducted an experiment and concluded that, the transition from the standard pedal to the combined brake-accelerator system is easy and relatively painless. Incorrect driving behaviors quickly abate, mostly before the driver completed 500 km of driving.



**Figure 1: Combined brake and accelerator set up (Nilsson et .al. 2002)**

Schwartz (2017) with his work concluded that the fuzzy controller worked much better in both cars when compared to the PID controller. The fuzzy controller had a steady state error of 1 mph in Car 1 and 2 mph in Car 2, while the PID controller had more than 4 in both cars. The poor performance of the PID controller was surprising considering that the PID method is the most common in the automobile industry. Perhaps a more experienced controls engineer could have tuned the PID controller to achieve better performance. A more advanced PID algorithm might also improve the performance.



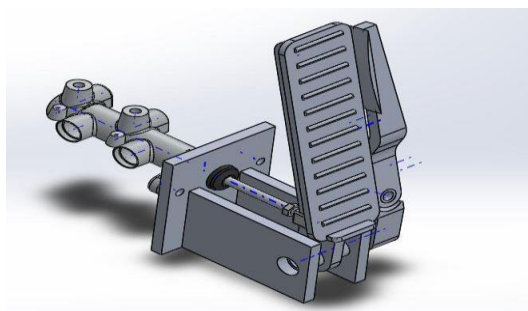
**Figure 2: Schwartz conceptual design**

### **III. OBJECTIVES**

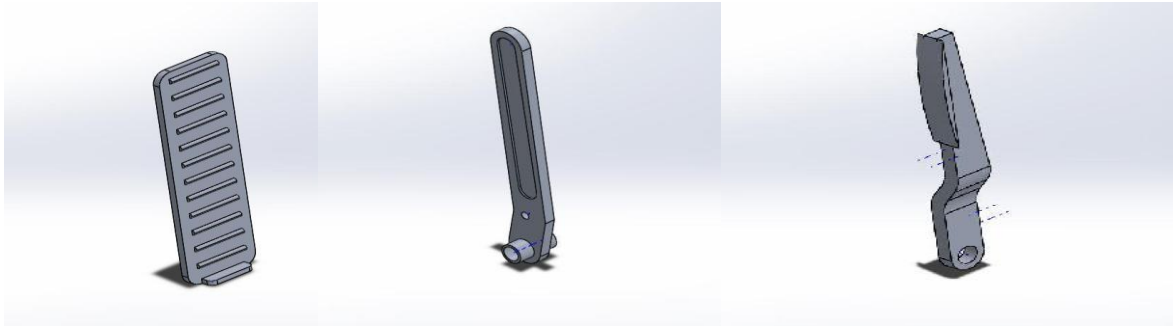
Design of single structure which consist of two systems i.e. braking system and acceleration system. Arranging the motions of two different pedals, so that can be handled by same foot. This helps in reducing the reaction time over transferring one leg from one pedal to another and thus reducing the accident rate.

### **IV. DESIGN OF BRAKE AND PEDAL**

For constructing the Combined Brake Accelerator pedal the following parts are needed such as, Aluminum 6061 bar, frame, master cylinder, torsion spring.

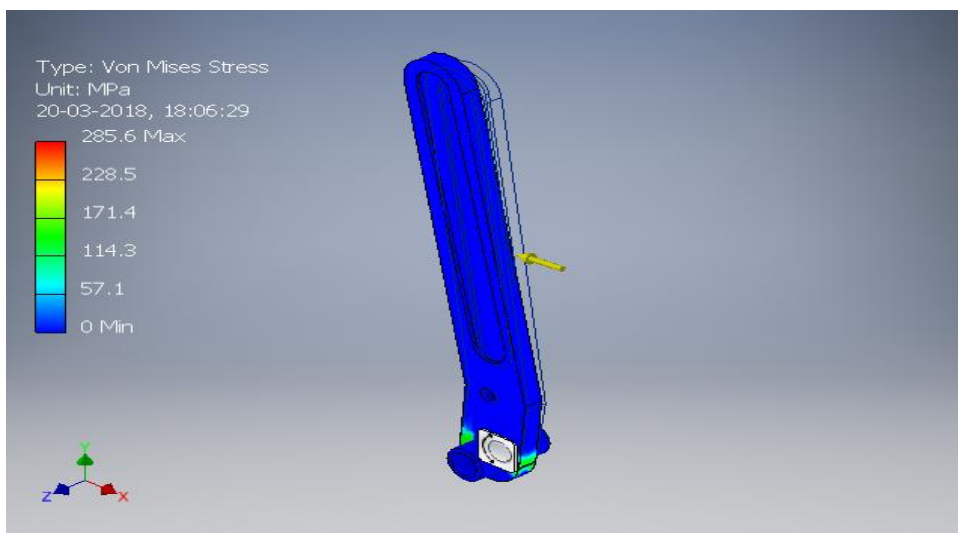


**Figure 3: Conceptual Design**

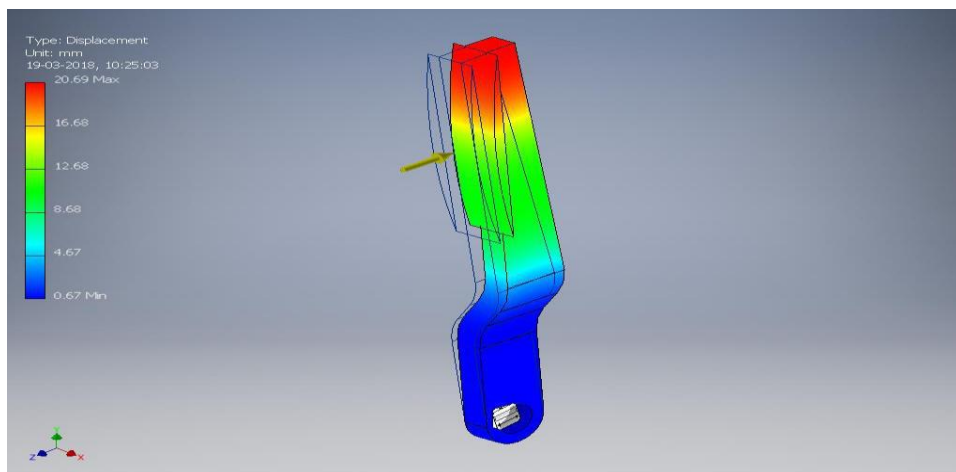


**Figure 4: Modeling of Brake pedal, Brake arm and Accelerator pedal**

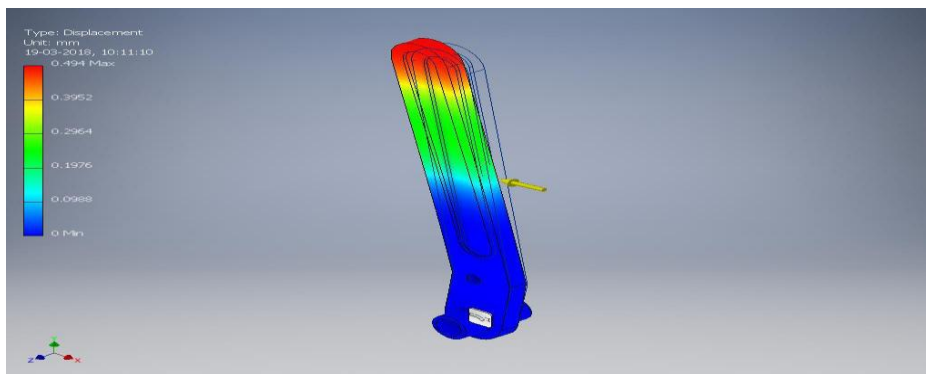
### V. ANALYSIS OF COMPONENTS



**Figure 5: Analysis of Brake pedal**



**Figure 6: Analysis of accelerator pedal**



**Figure 7: Analysis of Brake pedal arm**

## **VI. FINAL PROTOTYPE**



**Figure 8: Front view**



**Figure 9: Side View**

## **VII. CONCLUSION**

From this study we can infer that the various methods for developing and optimizing accelerator and brake pedal. We can also infer that the importance of composites towards automotive industry. This also shows that the importance of combined brake accelerator pedal system and need to incorporate in commercial vehicles in order to decrease the possibilities of accidents and it has proven low rate of errors and improved transition time between acceleration and braking. There is scope for this system and involves series of development and optimization in order to making into practice. This paper has presented the various methods involved in development and optimization of accelerator and brake pedal and the need for combined brake accelerator pedal.

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