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Fabrication of SUPRA Student Version

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Abstract: The abstract for the fabrication of a SUPRA [F1] vehicle outlines the goals and methodology of designing and manufacturing a four-wheeled student's Formula One kart. The project, undertaken by group, aimed to enhance driver control, performance, and overall driving experience. Here are the key points from the abstract:

- ***Objective: Design, improve, and manufacture a student's Formula One vehicle capable of handling various racing conditions.***
- ***Design Focus: Prioritize driver control, performance, maintainability, and mass production feasibility.***
- ***Opportunities: Motorsports in India offer untapped potential, creating business opportunities and job prospects.***
- ***Design Methodology:***
  - ***Universal Parts: Identify components with similar functions to reduce complexity, cost, and improve reliability.***
  - ***Safety and Aesthetics: Consider safety for chassis design and aesthetics for body, seat, and steering.***
  - ***Material Selection: Choose materials that withstand forces, vibrations, and high temperatures.***

This project not only enhances engineering skills but also contributes to India's growing automobile sector and provides adventure for racing enthusiasts.
Keywords: Mechanical Properties, Fuel Efficient, Security.

I. INTRODUCTION

With the rise of motorsports, it has created vast opportunities. For engineers, these opportunities comprise of designing and manufacturing them (motorsport vehicles).
To exploit future possibilities in automobile sector as engineers, we have designed a student formula vehicle that will be manufactured to enhance our engineering (designing and manufacturing). While designing chassis safety considerations are kept in mind whereas for designing body, seat, steering and other parts aesthetics and ergonomics of the vehicle were considered. The vehicle is designed to provide thrill and adventure to driver.

II. DESIGN METHODOLOGY

A. Material Selection

The integrity of a layout maybe ensured only after a scientific material selection method. Since the chassis needs to be designed for harsh riding situations, the choice of material turns into a critical part of design method. The chassis undergoes various kinds of forces at some stage in locomotion, it has to live intact without yielding and it must be stiff to absorb vibrations, additionally it need to withstand excessive temperature.

B. Engine

The engine must be a four-stroke, Otto-cycle piston engine with a displacement no greater than 710cc. Most commonly, production four-cylinder 600cc sport bike engines are used due to their availability and displacement. However, there are many teams that use smaller V-twin and single-cylinder engines, mainly due to their weight-saving and packaging benefits.

C. Weight

There is no weight restriction. The weight of the average competitive Formula SAE car is usually less than 440 lb (200 kg) in race trim. Several top-running teams have switched from high-powered four-cylinder cars to smaller, one- or two-cylinder engines which, though they usually make much less power, allow weight savings of 75 lb (34 kg) or more, and also provide much better fuel economy.
If a lightweight single-cylinder car can keep a reasonable pace in the endurance race, it can often make up the points lost in overall time to the heavier, high-powered cars by an exceptional fuel economy score.

D. Welding

Many distinct factors influence the strength of welds and the material around them, including the welding method, the amount and concentration of energy input, the weldability of the base material, filler material, and flux material, the design of the joint, and the interactions between all these factors

E. Safety

The majority of the regulations pertain to safety. Cars must have two steels roll hoops of designated thickness and alloy, regardless of the composition of the rest of the chassis. There must be an impact attenuator in the nose, and impact testing data on this attenuator must be submitted prior to competing. Cars must also have two hydraulic brake circuits, full five-point racing harnesses, and must meet geometric templates for driver location in the cockpit for all drivers competing.

III. MATERIAL SELECTION

AISI 4130 alloy steel contains chromium and molybdenum as strengthening agents. It has low carbon content, and can be welded easily.

Properties	AISI 4130	
Tensile strength, ultimate	560 MPa	81200 psi
Tensile strength, yield	460 MPa	66700 psi
Modulus of elasticity	190-210 GPa	27557-30458 ksi
Bulk modulus (Typical for steel)	140 GPa	20300 ksi
Shear modulus (Typical for steel)	80 GPa	11600 ksi
Poisson’s ratio	0.27-0.30	0.27-0.30
Elongation at break (in 50 mm)	21.50%	21.50%
Reduction of area	59.6	59.60%
Hardness, Brinell	217	217
Machinability (Annealed and cold drawn. Based on 100% machinability for AISI 1212 steel.)	70	70
Thermal conductivity (100°C)	42.7 W/mK	296 BTU in/hr.ft^2. °F

IV. ENGINE

Class	**Standard**
Engine	373.2 cc (22.77 cu in) 4-stroke, liquid-cooled single
Bore / stroke	89 mm × 60 mm (3.5 in × 2.4 in)
Compression ratio	12.6:1
Top speed	174–182 km/h (108–113 mph)
Power	• 32 kW (43 hp) @ 9,500 rpm (claimed) • 30.04 kW (40.29 hp) @ 9,600 rpm
Torque	• 35 N·m (26 ft·lb) @ 7250 rpm (claimed) • 32.92 N·m (24.28 ft·lb) @ 7,000 rpm

Fig.1 KTM 390 Engine

V. WELDING

MIG welding uses a constant voltage power supply to create an electric arc that fuses the base metal with a filler wire that is continuously fed through the welding torch. At the same time, an inert shielding gas is also fed through the gun, to protect the weld pool from atmospheric contamination. (Inert gases do not react with the filler material or the weld pool.)

A. Advantages of MIG Welding

1) MIG welding is a versatile technique suitable for various types and thicknesses of metal.
2) The continuously fed wire enables fast, uninterrupted welding resulting in shorter lead times and lower production costs.
3) MIG welding is a relatively clean welding processes, leaving little slag and minimal spatter.
4) A MIG torch handles horizontal, vertical or flat welding positions with ease.

VI. DESIGN

Fig. 2 Prototype of SUPRA kart

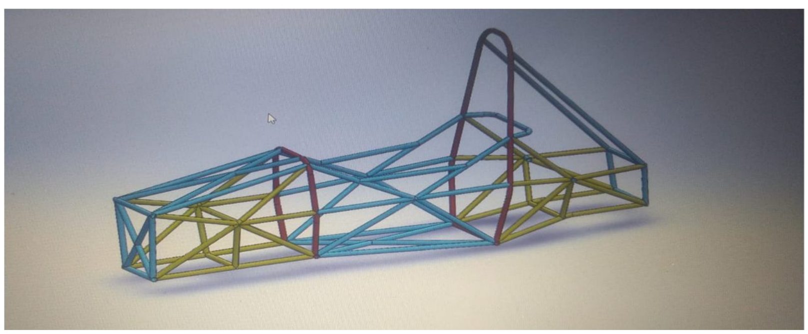


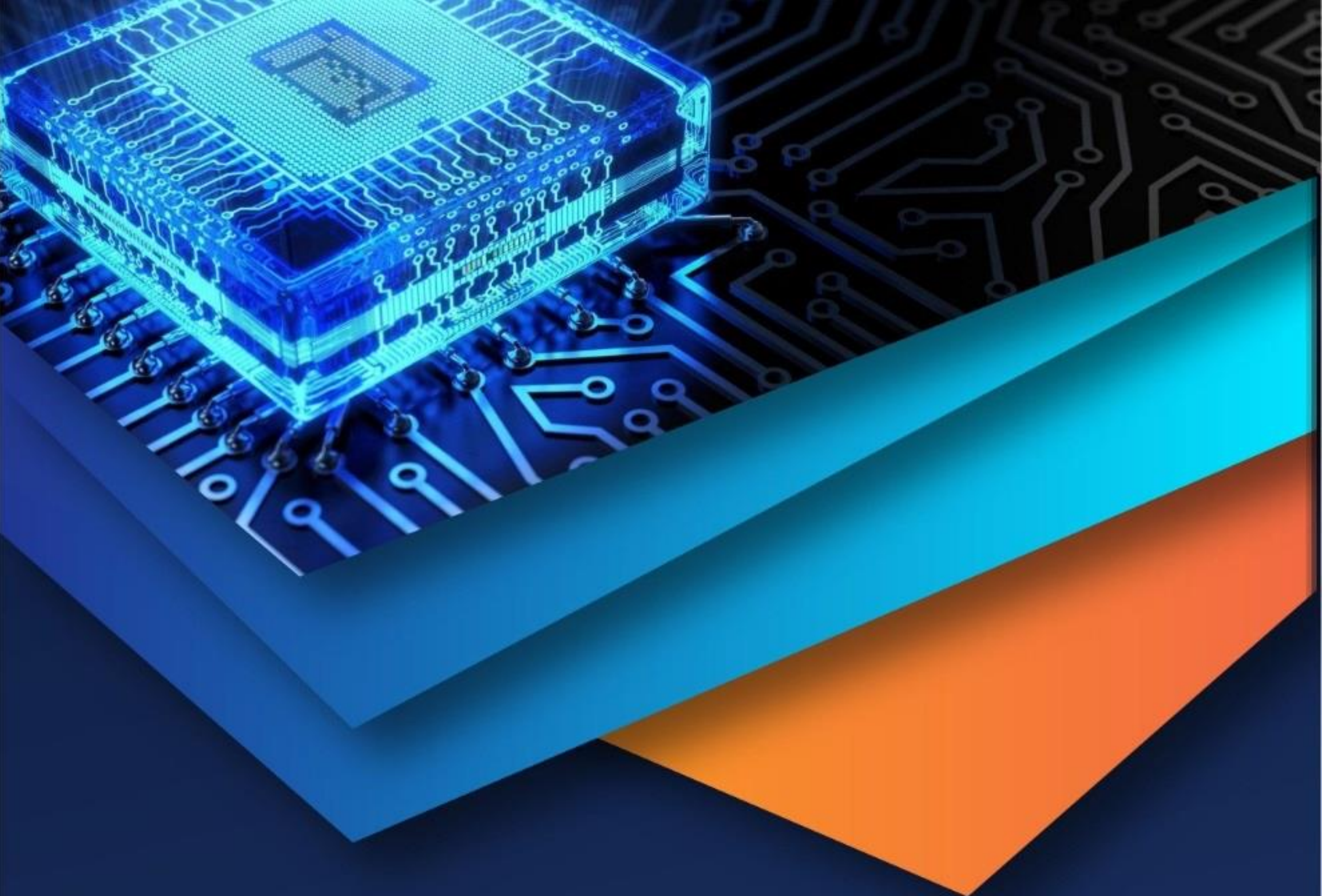
Fig. 3 CAD Model of SUPRA kart

VII. CONCLUSION

This paper focus on the design and fabrication of the SUPRA [F1] kart for the students. We perform various type of analysis on the chassis and found to be safe. We also learn that how to select the material for chassis design. Using the software like SOLIDWORKS and ANSYS WORKBENCH, we successfully perform the designing and analysis on the kart. The engine is selected such as to give the maximum performance in speed and fuel economy. Thus, after all finally concluded that vehicle is safe for fabrication.

REFERENCES

[1] https://www.researchgate.net/publication/308277514_Structural_Performance_Analysis_of_SAE_Supra_Chassis
[2] https://www.ijser.org/researchpaper/Design-and-Analysis-ofSuspension-System-with-Different-Material-for-SUPRA-SAEINDIA-2018.pdf
[3] https://www.ijert.org/research/analysis-of-formula-studentrace-car-IJERTV5IS100046.pdf
[4] https://www.researchgate.net/publication/270348937_2012-28-0027Design_Analysis_and_Testing_of_the_Primary_Structure_of_a_Race_Car_for_Supra_SAEINDIA_Competition#:~:text=The%20two%20most,conducting%20drop%20test.
[5] SUPRA SAEINDIA 2020 Rulebook.
[6] FORMULA SAE RULES 2023.



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