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DESIGN AND ANALYSIS OF GO KART

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ABSTRACT: A go-kart as known is a single seated simple car like vehicle. Our aim is to the design and analyse go kart chassis. The main intention is to do modelling and static analysis of go-kart chassis. The go-kart chassis are different from chassis of ordinary cars on the road. This highlights the material used and structural formation of chassis. The strength of material, rigidity of structure and energy absorption characteristics of chassis are to be discussed. The modelling and analysis are performed using 3-D software such as CREO, ANSYS. The loads are applied to determine the deflection of chassis. Our main aim is to maintain good ergonomics and safety

INTRODUCTION

1.1 INTRODUCTION TO GO-KART

Almost similar to the original go kart, in this project, the main achievement is to make a moving vehicle. A simple go-kart will be recreated and will be provided with a more advance safety system and gear shifting technology to improve the kart's handling and performance. The chassis are made of steel tube. There is no suspension therefore chassis have to be flexible enough to work as a suspension and stiff enough not to break or give way on a turn.

LITERATURE REVIEW

2.1 LITERATURE REVIEW OF GO KART

Design and Fabrication of Go-Kart, "Beela Ramanjaneyuly, International Journal & Magazine of Engineering, Technology, Management and Research", "June 2016, ISSN No;2348-4845", on that paper the Go-Kart is designed for a maximum speed of 40km here material used for construction is mild steel, for carrying load upto 150-200kg.The design in the form of F3 racing car, The steering mechanism used in it is mechanical steering mechanism, Chassis construction is normally of a square rod construction, Power transmission is done using chain drive.[1]

Design and Fabrication of Go-Kart, "C. Jagadeesh Vikram, International Journal of Innovative Research in Science ,Engineering and Technology", "September 2015, ISSN No;2319-8753", on that paper the Go-Kart is constructed by using steel, for carrying load upto 150-200kg.The steering mechanism used in it is rack and pinion steering mechanism, They have used hollow rectangular sections for chassis, Power transmission is done using \ 3

CAD MODELS

3.1 CAD MODEL OF VEHICLE
ISOMETRIC VIEW OF VEHICLE

SIDE VIEW OF VEHICLE

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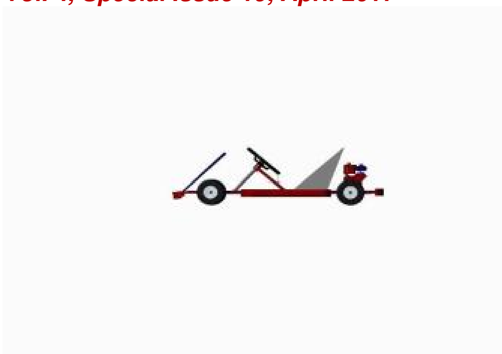


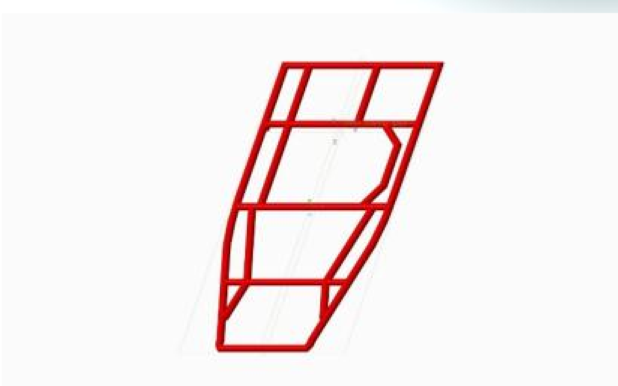
DESIGN ANALYSIS AND CALCULATION

4.1 CHASSIS

The frame is the main part of the chassis on which remaining parts of chassis are mounted. The frame should be extremely rigid and strong so that it can withstand shocks, twists, stresses and vibrations to which it is subjected while vehicle is moving on road. It is also called underbody. The frame is supported on the wheels and tyre assemblies. The frame is narrow in the front for providing short turning radius to front wheels. It widens out at the rear side to provide larger space in the body. Frame can be called as skeleton of a vehicle, besides its purpose being seating the driver, providing safety and incorporating other sub-systems of the vehicle, the main purpose is to form a

Chassis.

FRAME

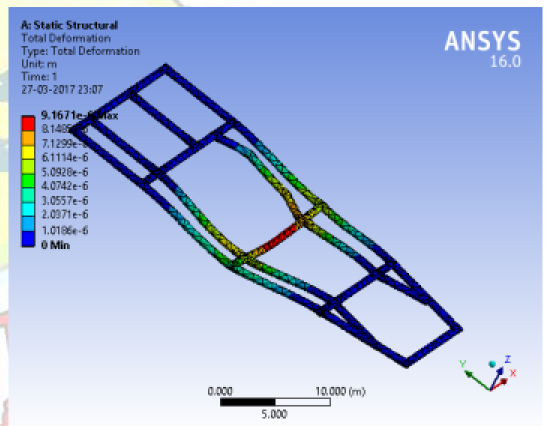


ANALYSIS

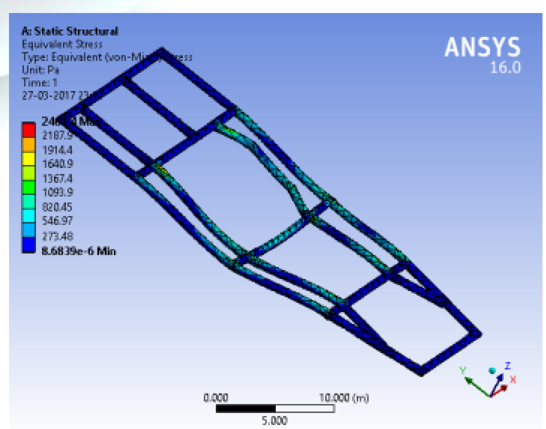
4.2 FRAME ANALYSIS

The material to be selected for frame should be feasible for manufacturing and strong enough to support all the components attached in frame. The Frame material should be less weight and highly efficient. The frame material should have less maintenance and corrosion resistance. The frame material should bear the impact and load.

Total Displacement of Aluminium



Equivalent Stress of Aluminium



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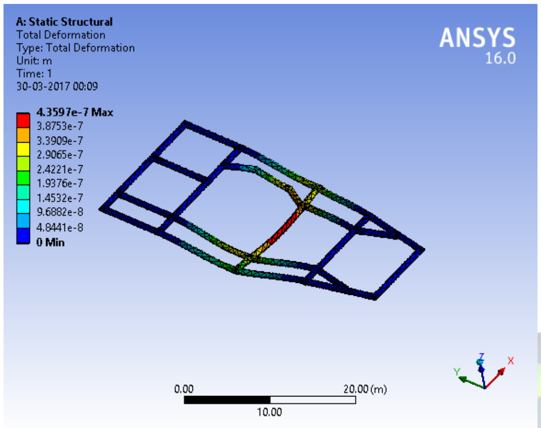
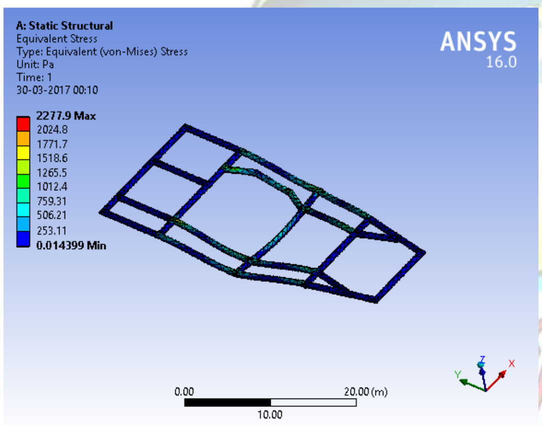
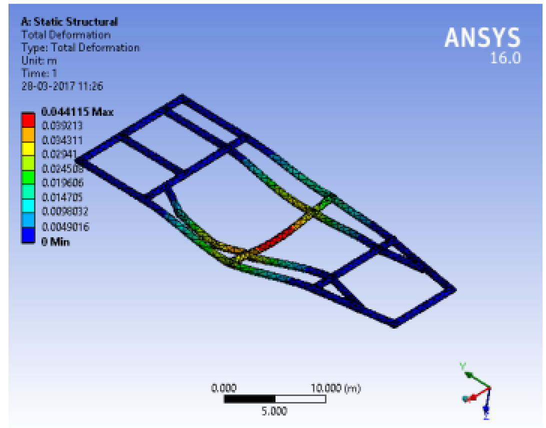
Total Displacement of Stainless Steel



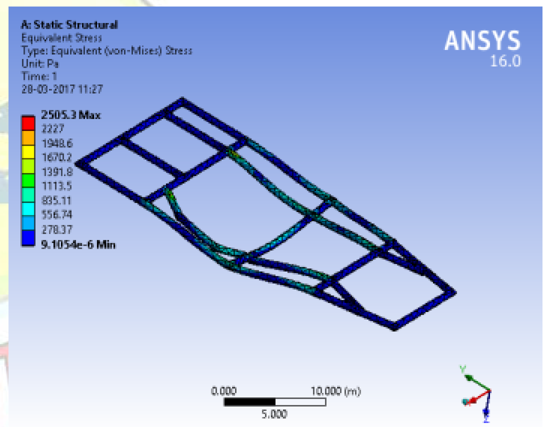
Equivalent Stress of Stainless Steel



Total Displacement of ASTM A106



Equivalent Stress of Stainless Steel



VEHICLE SUBSYSTEM SELECTION PROCEDURE WITH SPECIFICATION:

5.1 CHASIS/FRAME MATERIAL SELECTION:

- The material to be selected for frame should be feasible for manufacturing and strong enough to support all the components attached in frame.

- The Frame material should be less weight and highly efficient.

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- The frame material should have less maintenance and corrosion resistance.

- The frame material should bear the impact and load.

MATERIAL SELECTED: ASTM A106

TENSILE STRENGTH	**415 (MPa)**
YIELD STRENGTH	**240 (MPa)**
POISSON RATIO	**0.3**

5.2 TRANSMISSION SYSTEM:

Chain drives are popularly used in the automobile vehicles. We are using transmission chain and sprockets. It is also called as roller chains. A roller chains provides a readily available and efficient method for transmitting power between parallel shafts. They can be used for long as well as short centre distance. The transmission of power from motor to the rear axle is made by the chain and sprocket assembly. We are using continuous variable transmission system (CVT).

Smaller sprocket diameter =36.8mm
Outside diameter =41.8mm

Larger sprocket diameter =145.63mm

Outside diameter =150.71mm

Length of chain (L) =609.6mm Centre

distance (a) =152.14mm

5.3 STEERING SYSTEM:

The rotary motion of the steering hand wheel is carried to the steering shaft upper, steering shaft lower, steering gear box and pitman arm. Then as the pitman arm moves, the drag rod is caused to move linearly, actuating the tie rod to turn the wheels, right and left ,through their knuckle arms. The turning force exerted by the tie rod experience a damping action due to the presence of the oil seal at the sphere-like joint between the knuckle case and the inner case. Another damping action is available, which will be formed by the components are designed for easy steering, high durability and excellent steering reaction as well as reliable self-restoring action. Articulated joints in the steering lever is equipped with a damping device for ensuring the greater steering stability. Linkage are of wear resistant ball-and-socket type. Pitman arm is equipped with a damping device for ensuring the greater steering stability.

Steering box		Recirculating ball-and-nut type
Gear ratio		15.6-18.1
Steering angle, inside		$29^{o} \pm 3^{o}$
Steering angle, outside		26^{o} 26^{o}
Steering wheel diameter		400 mm (15.74 in.)
Min turning radius		5.1 m (16.1 ft.) *6.0 m (19.7 ft.)
Wheel alignment	Toe-in	2-6 mm (0.079-0.236 in.)
	Camber	1 degree (1^{o})
	Kingpin inclination	9 degree (9^{o})
	Caster	3 degree 30 min (3^{o} 30’),14.5 mm
	Side slip	0-in 3m/km

5.4 HYDRAULIC BRAKING SYSTEM:

An excellent braking system is the most important safety feature of any land vehicle. We selecting the disc brake system. The main requirement of the vehicle’s braking system is

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that it must be capable of locking all four wheels on a track.

Ease of manufacturability, performance and simplicity are a few important criteria considered for the selection of the braking system. A disc brake is a wheel brake which slows rotation of the wheel by the friction caused by pushing brake pads against a brake disc with a set of calipers. The brake disc (or rotor in American English) 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 stop the wheel, friction material in the form of brake pads, mounted on a device called a brake caliper, is forced mechanically, hydraulically, pneumatically or electromagnetically against both sides of the disc. Friction causes the disc and attached wheel to slow or stop.
Brakes convert motion to heat, and if the brakes get too hot, they become less effective, a phenomenon known as brake fade. 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 brake fade; and disc brakes recover more quickly from immersion (wet brakes are less effective). Most drum brake designs have at least one leading shoe, which gives a servoeffect.

By contrast, a disc brake has no selfservo effect and its braking force is always proportional to the pressure placed on the brake pad by the braking system via any brake servo, braking pedal or lever. This tends to give the driver better "feel" to avoid impending lockup. Drums are also prone to "bell mouthing", and trap worn lining material within the assembly, both causes of various braking problems.

The brake disc is the disc component of a disc brake against which the brake pads are applied. The material is typically grey iron, a form of cast iron. The design of the disc varies somewhat. Some are simply solid, but others are hollowed out with fins or vanes joining together the disc's two contact surfaces (usually included as part of a casting process). The weight and power of the vehicle determines the need for ventilated discs. The "ventilated" disc design helps to dissipate the generated heat and is commonly used on the more-heavily-loaded front discs. [3] proposed a system, this fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller.This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

Many higher-performance brakes have holes drilled through them. This is known as cross-drilling and was originally done in the 1960s on racing cars. For heat dissipation purposes, cross drilling is still used on some braking components, but is not favored for racing or other hard use as the holes are a source of stress cracks under severe conditions.

Discs may also be slotted, where shallow channels are machined into the disc to aid in removing dust and gas. Slotting is the preferred method in most racing environments to remove gas and water and to deglaze brake pads. Some discs are both drilled and slotted. Slotted discs are generally not used on standard vehicles because they quickly wear down brake pads; however, this removal of material is beneficial to race vehicles since it keeps the pads soft and avoids verifications of their surfaces.

As a way of avoiding thermal stress, cracking and warping, the disc is sometimes mounted in a half loose way to the hub with coarse splines. This allows the disc to expand in a controlled symmetrical way and with less unwanted heat transfer to the hub.

On the road, drilled or slotted discs still have a positive effect in wet conditions because the holes or slots prevent a film of water building up between the disc and the pads. Cross-drilled discs may eventually crack at the holes due to metal fatigue. Cross-drilled brakes that are manufactured poorly or subjected to high stresses will crack much sooner and more severely.

5.5 WHEELS:

FRONT WHEEL:

The front wheel assembly has a Front wheel hub and has a kingpin through which the front wheel is assembled in the vehicle. The front wheel has the bearing setup in their rims, so it just rolls with the acceleration of the rear wheel.

REAR WHEEL:

The rear wheel is assembled on the rear axle shaft directly. There is no bearing setup in the rear wheels. So it runs with the power of the motor which is transmitted to rear axle by chain drive.

BODY WORK:

We are using carbon fibre for all bumpers in the go-kart.

CONCLUSION

In this work, a detailed methodology of the virtual design and analysis has been presented including the reasoning of using the materials used for the fabrication of the chassis and axle. Also, the reasoning of fabrication of new chassis design of go-kart which is different than the chassis design of the standard Go-Kart has been given and proven.

Even if the entire process of design and analysis proposed has shown interesting results but methodology must be still validated through dynamic experimental tests. This will allow the creation of mathematical model completely defined and validated, giving the basis of future developments regarding the optimization process of go-kart performance.

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