Fabrication of Quad Bike

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Abstract

ATV stands for all-terrain vehicle also known as Quad-Bike. The purpose of fabricating a Quad-Bike was to manufacture an off-road vehicle that could help in transportation in hilly areas, farming field and as a reliable experience for a weekend enthusiast. The machine used in the fabrication of the chassis was lathe, grinding machine, cutting machine and the welding was done by MIG, TIG and Arc. And the software used as per the designing purpose was Catia, SolidWorks and Fusion 360. Material used was AISI 1020 steel and the Result was able to successfully modify a 2-wheeler bike (Yamaha RX-100) into a 4-wheeler ATV. The objective of designing a single-passenger off-road race vehicle with high safety and low production costs seems to be accomplished. The design was first conceptualized based on personal experiences and intuition.

Keywords: ATV, Quad Bike, Fabrication.

Introduction

The **all-terrain vehicle** (**ATV**), also known as a **Quad-Bike**, **three-wheeler**, four-wheeler as defined by the American National Standards Institute (ANSI) is a vehicle that travels on low-pressure tires, with a seat that is straddled by the operator, along with handlebars for steering control. As the name implies, it is designed to handle a wider variety of terrain than most other vehicles.

By the current ANSI definition, ATVs are intended for use by a single operator, although some companies have developed ATVs intended for use by the operator and one passenger. These ATVs are referred to as tandem ATVs.

The rider sits on and operates these vehicles like a motorcycle, but the extra wheels give more stability at slower speeds. Although equipped with three or four wheels, six-wheel models exist for specialized applications.

The objective of this report is to highlight the fabrication of the Quad-Bike vehicle. Based on the analysis and design the model was retested with boundary conditions under the practical parameters and fabrication of the chassis was done after the design process was completed the fabrication was done with the help of machines such as grinding machine, lathe, cutting machine and welding process for the joining and for finishing of the chassis body. So, the design and body layout focuses on safety, serviceability, strength, ruggedness, standardization, cost, ergonomics and aesthetics. The fabrication objectives set out to be achieved were three simple goals, applied to every component of the bike: durable, lightweight, and high performance, to optimizing the design by avoiding over designing, which would also help in reducing the cost. With this we had a view of our quad bike. Our college has provided us a well-equipped laboratory and guided in all aspects. This started our goal and we set up some parameters for our work, distributed ourselves in groups.

Material used for fabrication

The metal rod used in the chassis frame was AISI 1020 steel and the dimensions of the rod was 1-inch outer diameter and ¾ inch inner diameter and the sheet metal used in the body design was stainless steel of 2 mm thickness. The material used for the chassis of this Quad-Bike is AISI 1020 steel the chemical compositions and material properties of the steel are listed below in the TABLE 1.1 and TABLE 1.2, as there is also a seamless bar available of mild steel which is very good for automobile manufacturing though it has good absorbing, vibration, strength and other properties our motive is to minimize the cost of our product as this material is not easily available in our local market for this we have to import this material from other market which is able to increase transportation cost and thus our product cost so we just go for the different material which has similar property which is easily available in our local market at low cost .

Table 1.1: Chemical compositions of AISI 1020 steel

Element	Content (%)
Manganese, Mn	0.30-0.60
Carbon, C	0.18-0.23
Sulphur, S	0.05 (max)
Phosphorous, P	0.04 (max)
Iron, Fe	Balance

Table 1.2: Material properties of AISI 1020 steel.

Properties	Metric
Tensile strength	420 MPa
Yield strength	350 MPa
Modulus of elasticity	205 GPa
Shear modulus (typical for steel)	80 GPa
Poisson's ratio	0.29
Elongation at break (in 50 mm)	15%
Hardness, Brinell	121
Hardness, Rockwell B (converted from Brinell hardness)	68
Machinability (based on AISI 1212 steel. as 100 machinability)	65

Fabrication of the Quad-Bike

The fabrication was done on the old Yamaha RX-100 in which we built the new chassis and body layout, before working on the mild steel we made design on CAD software and as per design the model of project with the help of PVC pipe was made which helped to demonstrate proper design layout of the project and after that the process like cutting of metal rod, grinding, welding, drilling on the steel was done to make chassis of the Quad-Bike and then for the fabrication of the body the cutting of sheet metal was done, then cleaning of the metal surface,

primer coating on the metal was accomplished and then the surface of Quad-Bike was coated with the metal paint, after paint, polishing of the metal part was done.

1 Making model by PVC pipe

Before working on the steel we made design on CAD software and as per design, the model of the project with the help of PVC pipe was made which helped to demonstrate proper design layout of the project.

Fig 1: The PVC model

2 Chassis and frame of the quad bike

The chassis is the component in charge of supporting all other vehicle's subsystems with the plus of taking care of the driver safety at all time. The chassis design need to be prepared for impacts created in any certain crash or rollover. It must be strong and durable taking always in account the weight distribution for a better performance. In case of vehicles, the term rolling chassis means the frame plus the "running gear" like engine, transmission, drive shaft, differential, and suspension.

2.1 Cutting and Grinding

Cutting is the separation of a physical object, into two or more portions, through the application of an acutely directed force, as per the design the metal rod was cut with the help of metal cutter, hacksaw and with lathe machine and the sharp edges was trimmed with the help of grinding machine as grinding can produce very fine finishes and very accurate dimensions, the grinding and cutting was used in the project to provide the correct measurement of the metal for making chassis.

2.2 Drilling

Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials in this process the metal rod and metal sheet is drilled to provide holes for the fastener and for joining of the chassis parts.

Fig 2: Chassis design

2.3 Welding

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing fusion, which is distinct from lower temperature metal joining techniques such as brazing and soldering, which do not melt the base metal. In addition to melting the base metal, a filler material is typically added to the joint to form a pool of molten

material (the weld pool) that cools to form a joint that is usually stronger than the base material. Pressure may also be used in conjunction with heat, or by itself, to produce a weld.

Although less common, there are also solid state welding processes such as friction welding or shielded active gas welding in which metal does not melt.

Some of the best known welding methods include:

1. Oxy-fuel welding
2. Shielded metal arc welding (SMAW)
3. Gas tungsten arc welding (GTAW)
4. Gas metal arc welding (GMAW)
5. Flux-cored arc welding (FCAW)

The Arc welding and MIG welding was used in the joining of the metal rod for completing the chassis of the Quad-Bike.

Fig 3: Welding on the chassis and body

3 Fabrication of Outer Body by Sheet Metal

Sheet metal is metal formed by an industrial process into thin, flat pieces. It is one of the fundamental forms used in metalworking and it can be cut and bent into a variety of shapes. The body of the Quad-Bike was completed with the help of sheet metal the sheet metal was cut as per the measurement, the sheet metal used in the Quad-Bike body design was stainless steel of 2 mm thickness. The sheet metal was cut with the help of snips, Snips, also known as shears, are hand

tools used to cut sheet metal and other tough webs then the sheet metal was band as per design require, Sheet metal bending is the plastic deformation of the work over an axis then the sheet metal was join with the help of welding process we used MIG welding for joining the sheet metal and also sharp edges of the sheet metal was bended to avoid injury.

Fig 4: the top and front view of outer body

4: Finishing of the outer body

After completing the chassis, the outer body and the chassis was painted. The metal painting process considered like cleaning the body of the Quad-Bike as wipe away all paint dust with a damp cloth. Scrape off any hunks of remaining paint. Using a fresh cloth to give your metal a thorough rub down, cleaning off all loose paint, dirt, greasing and griming from the surface and then primer was done on the surface as metal primers might contain additional materials to protect against corrosion, such as sacrificial zinc, after that the Quad-Bike was painted with the help of the metal paint then the Quad-Bike was left untouched for a day to dry the paint.

Fig 5: Primer on the chassis

Result and discussion

The design of the ATV was completed in the CAD software then fabrication group by taking the design consider the old two-wheel bike modified into a 4-wheel quad bike, many trials were conducted and these results were compared to a series of tests collected from the other completed atv projects. In starting of the project, we faced lots of difficulty as what type of material we use what is the design of our Quad-Bike and what the other feature will be added to it and we fabricated our Quad-Bike as to carry the same layout and feature as compare to other completed ATV project

Final completed project

Fig 6: Front view of the Quad-Bike.

Conclusion

The objective of fabrication a single-passenger off-road race vehicle with high safety and costs seems to be accomplished as before working on the project our main motto was to complete the project in low time and minimum production cost. The design was first conceptually based on personal experiences. Engineering principles and design processes were then used to verify and create a vehicle with optimal performance, safety, and ergonomics. The design process included using SolidWorks, Catia, Fusion 360 software packages to model, simulate, and assist in the analysis of the completed vehicle. After initial testing it was seen that our design must improve the design and durability of all the systems on the bike and make any necessary modification.

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