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Design and Structural Analysis on XR 400 Wheel hub by varying Materials

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ABSTRACT: In the present study we have taken Xr400 Wheel hub for the consideration whereas it was the component that helps in steering system. It allows the wheel to turn freely according to the driver's dependence. The most amount of load carrying or varying on the vehicle was wheel and its hub so the material selection should be given a main importance various weight also plays a major role in load capacity as well performance and safety factor. Xr 400 is a motorcycle that was with a 400cc that was also used in off road conditions. When the vehicle in uneven roads definitely the vehicle suspension and next he wheels hub assembly will get affected with jerks and bumps. So the in this project we have taken XR 400wheel hub in consideration and created the model in Catia V5 that was saved in STP file and later analysis was carried out on wheel hub with five different materials at two different rpms. And later wall thickness analysis was also carried on a wheel hubto know that there is a uniform thickness maintained along the component. In this present project strength materials, design of machine members, and finite element analysis was taken into consideration.

KEYWORDS: Wheel hub, structural analysis, CATIA v5 , FEM

I. INTRODUCTION

The Honda XR series is a series of motorcycle with off-road motorcycles that were designed in Japan but assembled worldwide. Another XR series comes in two versions: R and L. The R version bikes were enduro machines designed for competitive off-road riding. They were fitted with off-road tires and were illegal on the roads. The L version models were dual-sport bikes, fitted with headlights, indicators, horn, and official road tires. A The smaller XR models include the XR50R, XR70R, XR75R, XR80R and XR100R.



They are very small in size compared to other bikes in the series, and are younger riders, like pit bikes. Its frame, plastic and suspension parts were similar to those of the XR250R, and it had the same air-cooled engine with RFVC cylinder head technology. The XR400R had more suspension pitch and wheelbase than the XR250R of that year. Most XR400Rs are highly modified and running. The 400 was probably the most variable on the XR list; many compete in



ateur and euro motocross events. It is fitted with official street lights and also works well as a dual-purpose bicycle. It was simple, reliable and durable. It is hard to break and easy to repair. In 2004 Honda dropped the XR400R.

II. MATERIAL AND MANUFACTURING PROCESSES

The Selection of material was the major task in order to get the accurate result with the best output Iron or grey iron, is a type of pointed metal with a graphitic microstructure. It is named after the grey part of the component, which is due to the presence of graphite. It is the most commonly identified metal and is widely used with weight-based steel. Stainless steel also called rustless steel, is any group of metal alloys that contain at least 11% chromium, a structure that prevents metal from corrosion and provides heat-resistant materials. Different types of stainless steel include elements of c, al, si, Certain types of stainless steel are usually defined by their three-letter AISI number, eg 304 stainless steel. Austenitic stainless steel is a large family of stainless steel, making up about two-thirds of all stainless steel production. They have an austenitic microstructure, which is a structure of cubic crystals centered on the surface. This small structure is accomplished by combining iron with sufficient nickel and / or manganese and nitrogen to maintain an austenitic microstructure at all temperatures, from cryogenic to melting point. Therefore, austenitic stainless steel is not as resistant to heat treatment as it has the same structure at all temperatures. A building metal is a piece of metal used to make building materials in various ways. Metal structure conditions, sizes, chemical composition, mechanical properties such as energy, storage processes, etc., are regulated by standards in many industrialized countries. Many structural steel structures, such as I-beams, have a second maximum localization, which means that they are much stronger in relation to their cross-sectional surface and thus can support a larger load without overheating. Aluminium (or aluminium in American English and Canadian English) is an Al-marking chemical with an atomic number 13. Aluminium has a lower capacity than other conventional metals, about one-third of steel. It has a good oxygen-binding bond, and forms a protective layer of oxide on top when exposed to air. In the forging process, the AZ61 is widely used, and here the alloy M1 is used where low power and AZ80 high power are required. For extrusions, a variety of shapes, bars, and tubes are made from M1 alloy where low power is sufficient or where welding in M1 castings is arranged. The alloys AZ31, AZ61 and AZ80 are used for extrusions in the designated sequence, where the increase in power justifies their rising costs. [quote full] Magnox (a mixture), its abbreviated name for "magnesium non-oxidizing", is 99% magnesium and 1% aluminium, and is used in the fusion of fuel rods into nuclear power plants.

Material	Density in kgm-3	Poisson Ratio	Young’s modulus	Shear modulus	Bulk Modulus
Structural Steel	7850	0.3	2.e+11	7.6923e+10	1.6667e+11
Stainless Steel	7750	0.31	1.93e+11	7.3664e+10	1.693.e+11
Grey Cast Iron	7150	0.28	1.1e+11	4.2969e+10	8.333e+10
Aluminium Alloy	2170	0.33	7.1e+10	2.669e+10	6.96e+10
Magnesium Alloy	1740	0.35	4.1e+10	1.667e+10	5.1e+10

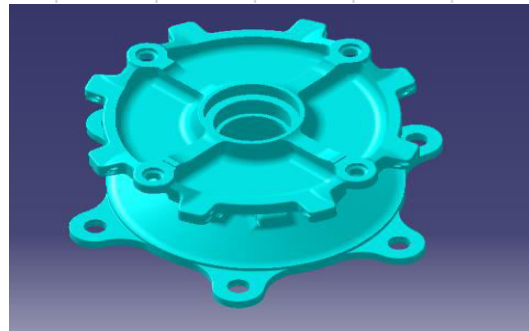
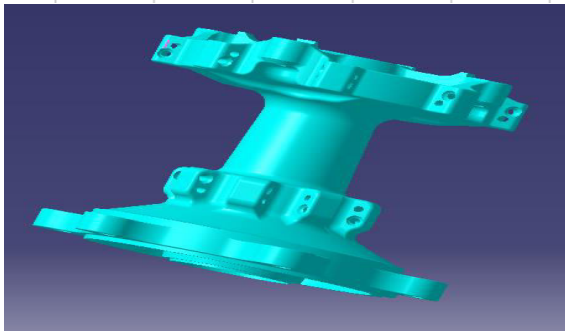
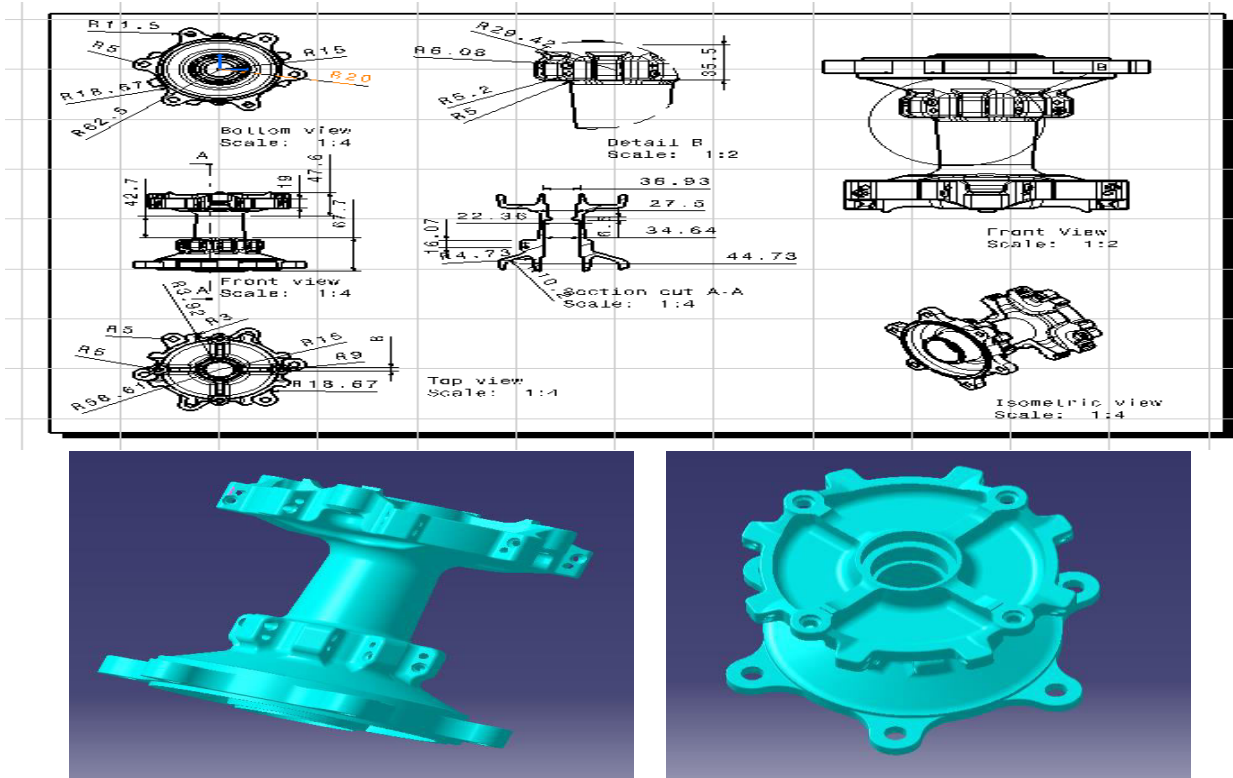
Table 1 shows the materials properties

III. MODELLING AND ANALYSIS PROCEDURE

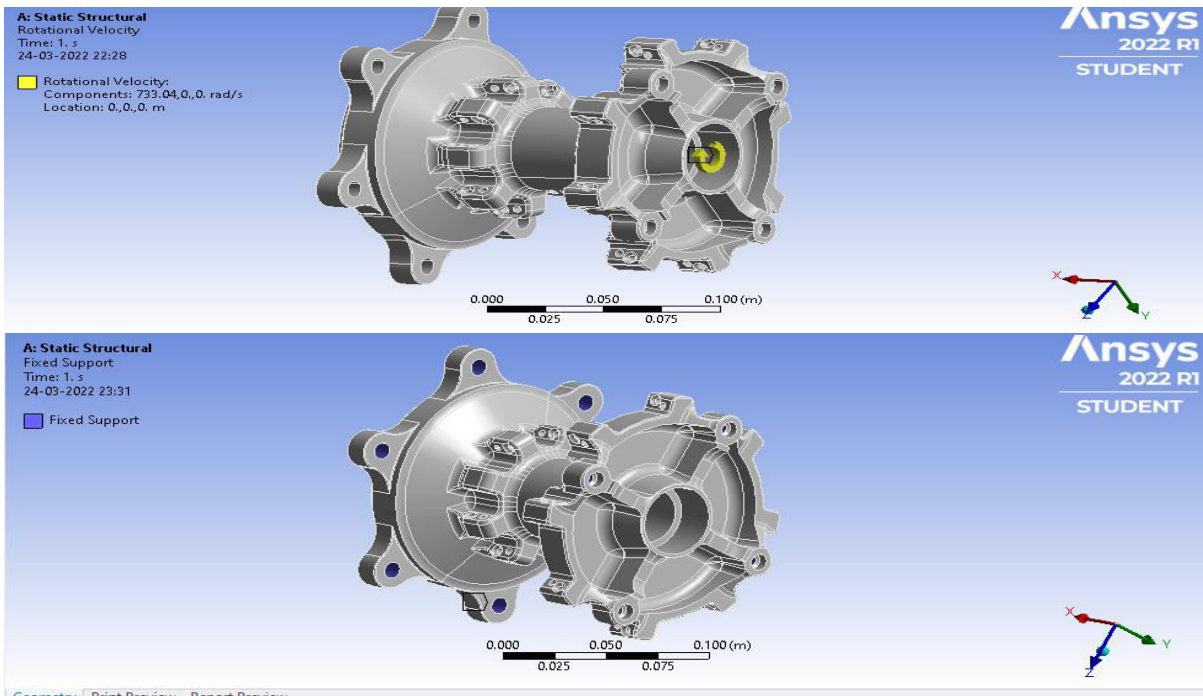
The modelling of the wheel hub was carried out in catia v5r21 Computer-assisted design programs are powerful tools for mechanical design and geometry of products and materials. There are many good reasons to use the CAD program to fund construction work The software allows the human user to transform the hardware configuration into a powerful design and production system. Procedure as follows Open the catia software and click on the start <Mechanical Design <design section. Identify the part of the feature that can be easily identified. Enter a single point point that acts as a reference point. Then create an axis system with location reference.: Select the body and axis needed to click the drawing to create the drawing.: Introduce the body as a large body to function as a large body and other activities will be done with the body as needed. Example: Remove, slot, handle etc. Click the profile command to draw the first drawing make sure the drawing should be tied and closed. The bound drawing is in green and the drawing analysis



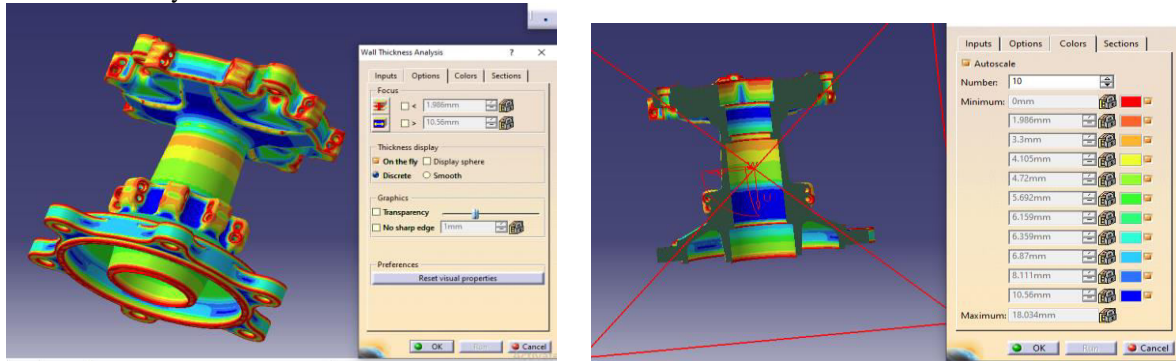
command is used to check if the drawing is open or closed. Get out of the drawing job bench. Build a drawing into a solid model of the required size Using the pad command from the drawing feature based on the drawing. Save the file in STP format that can easily open in ANSYS.



IV. LOADING CONDITION

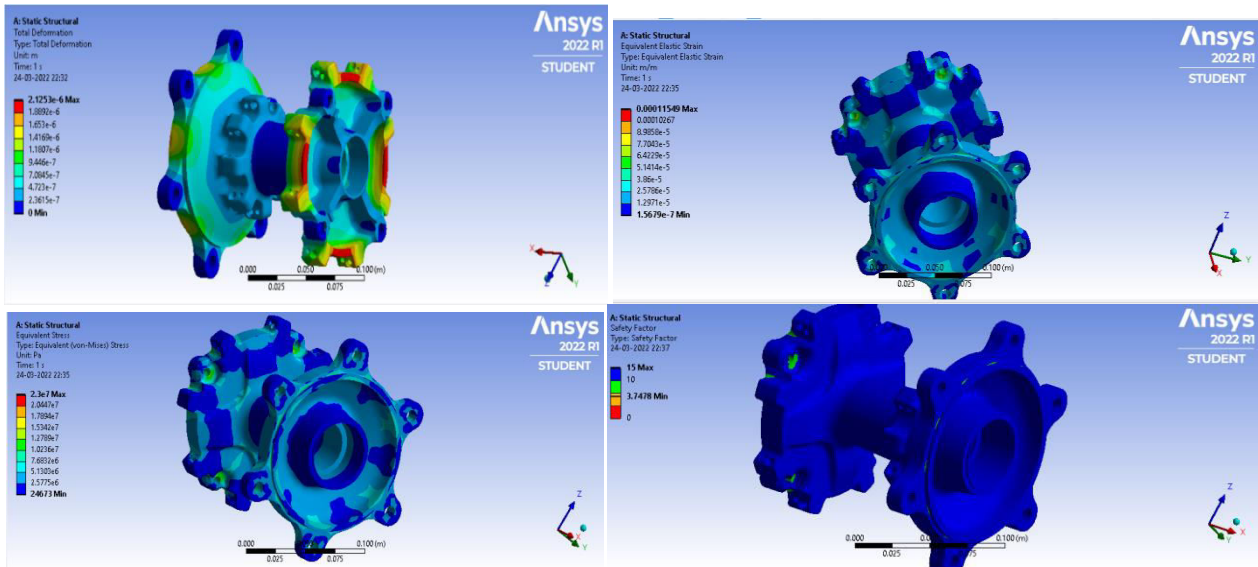


Wall Thickness analysis

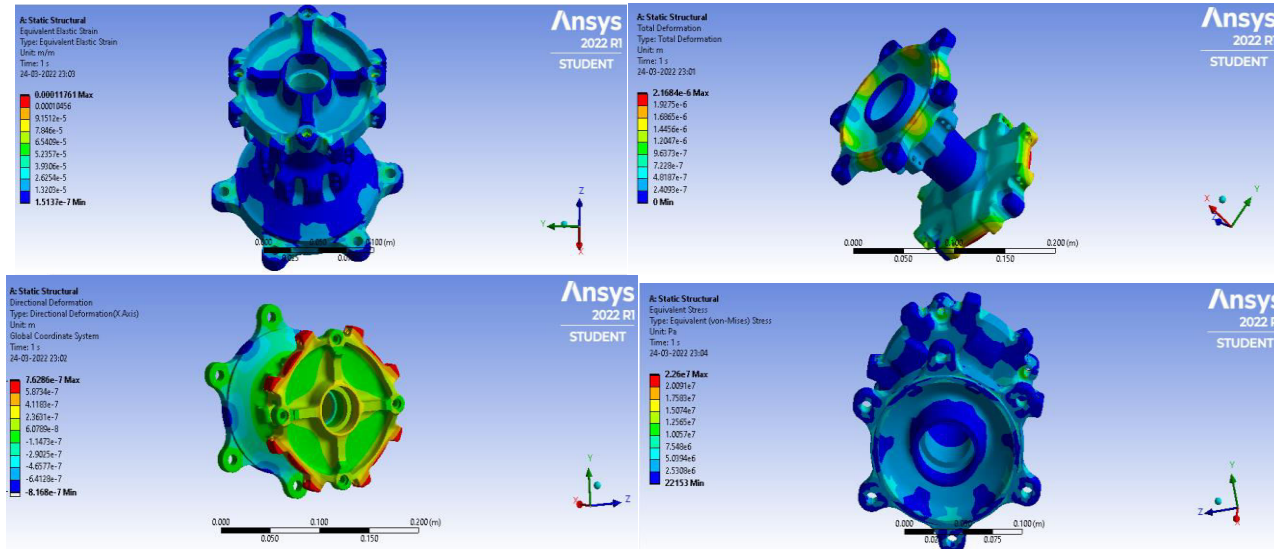


V. EXPERIMENTAL RESULTS

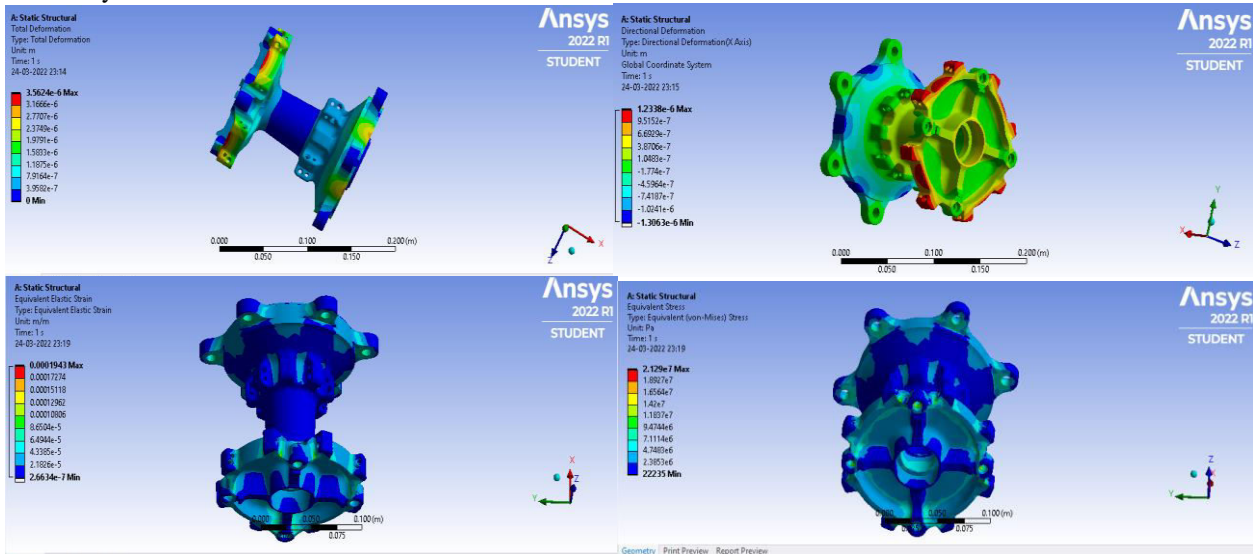
The experiment was carried out at 2 different rpms and five different materials. At 500rpm With structural steel



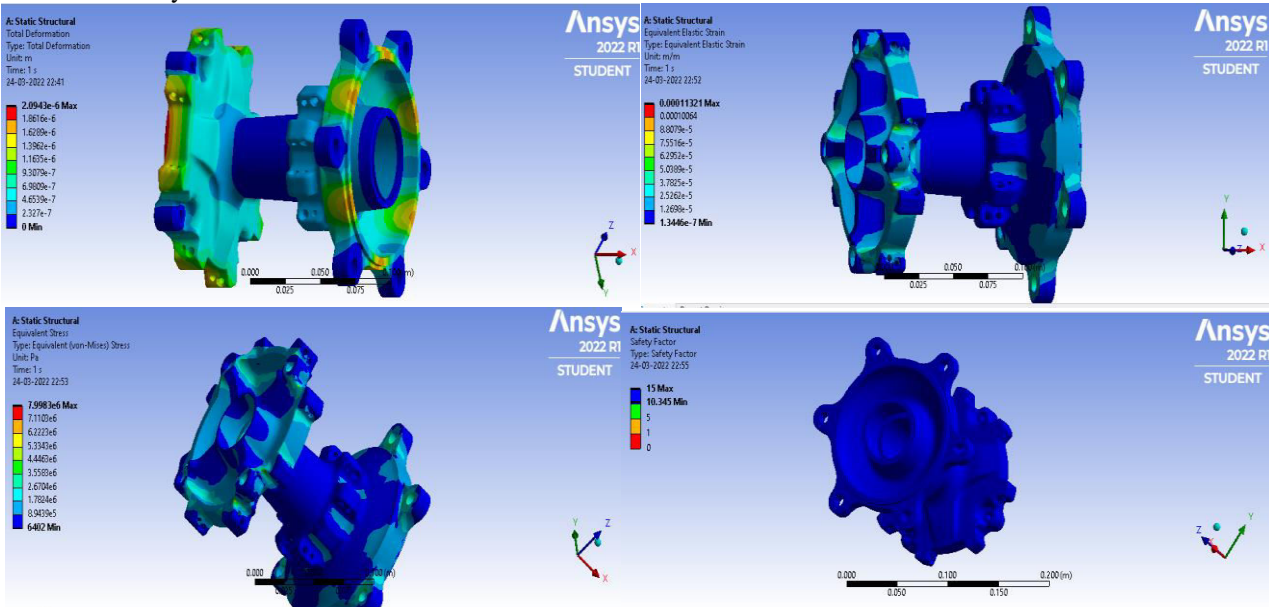
Stainless steel



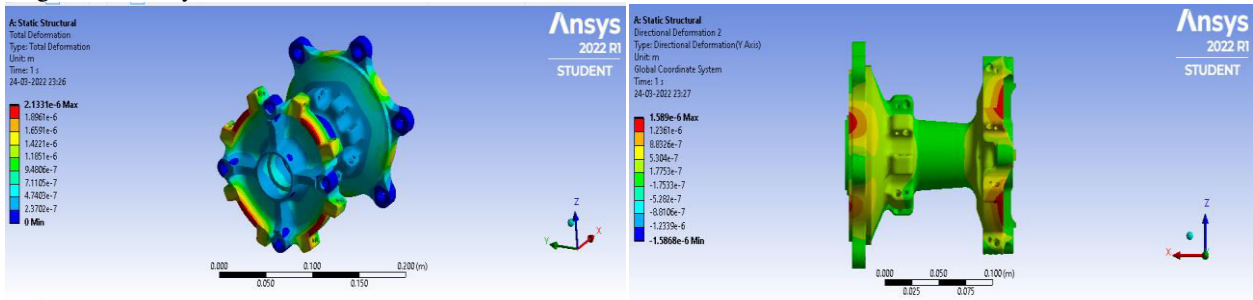
With Grey Cast iron

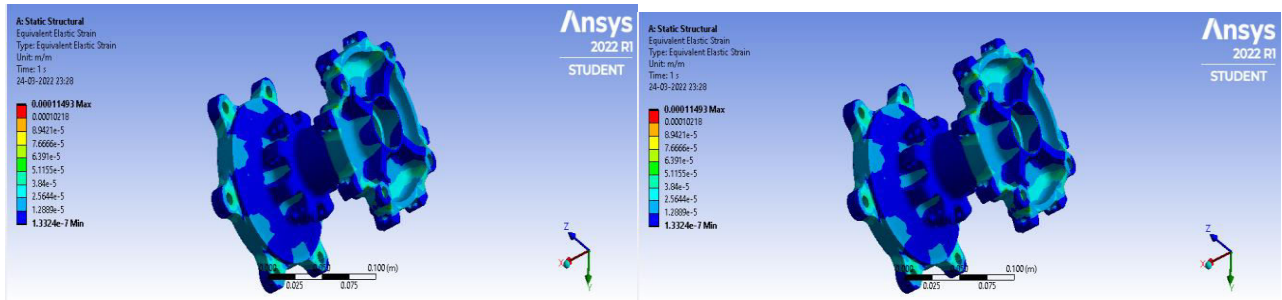


Aluminum Alloy

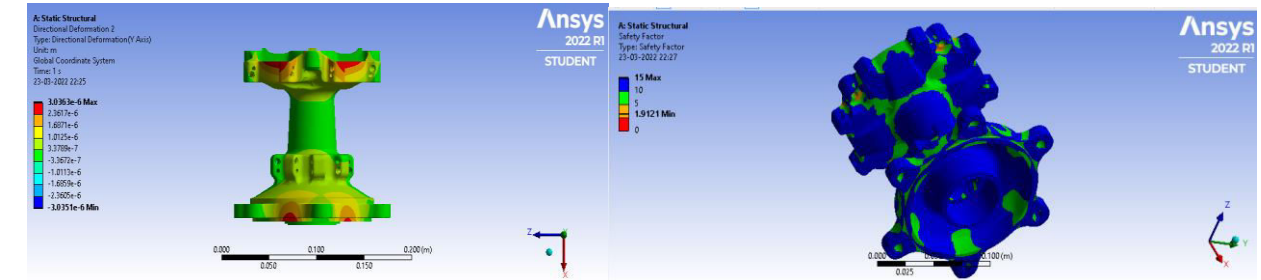
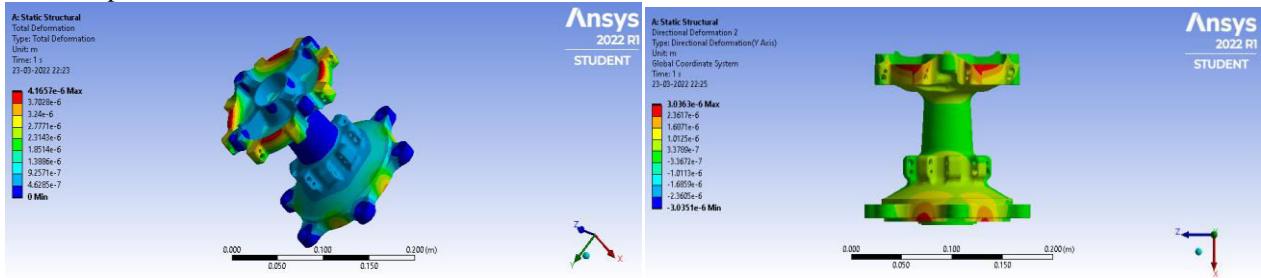


Magnesium Alloy

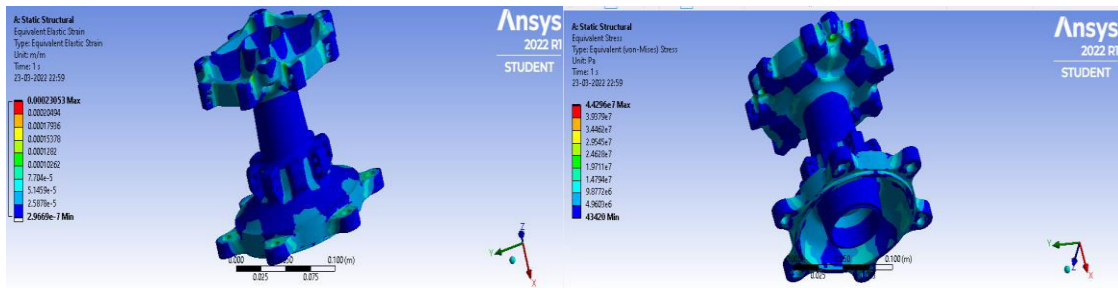
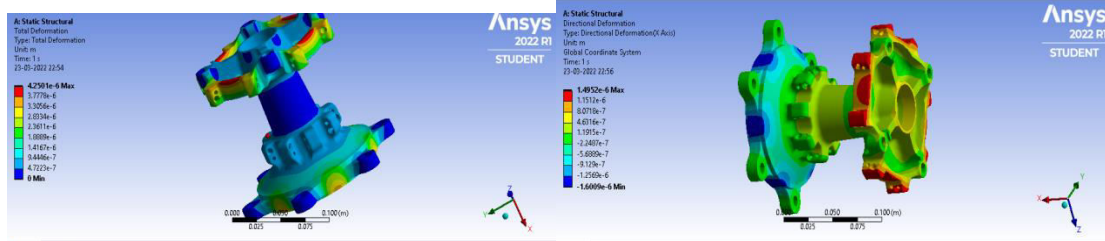




For 7000rpm Structural steel

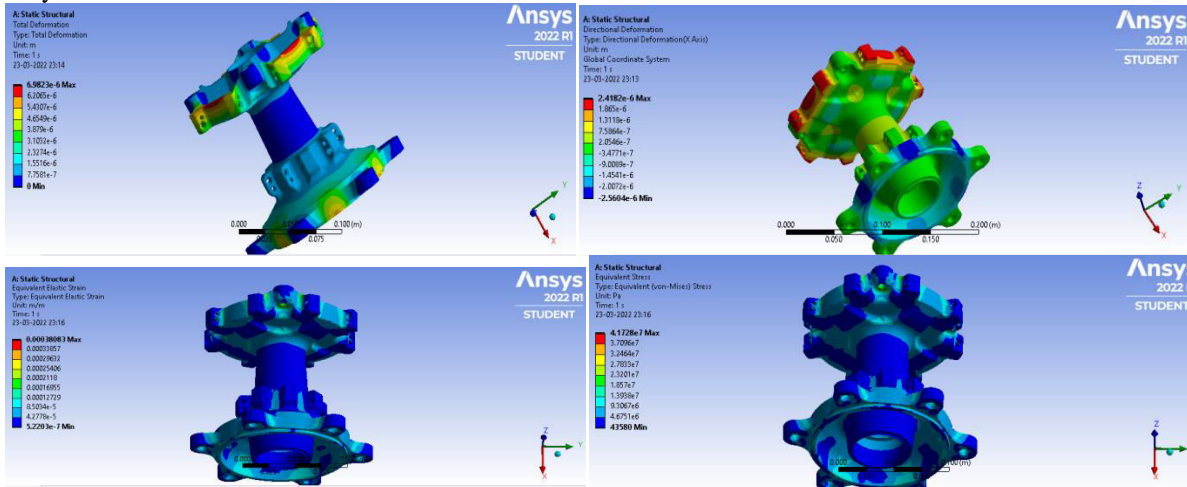


Stainless steel

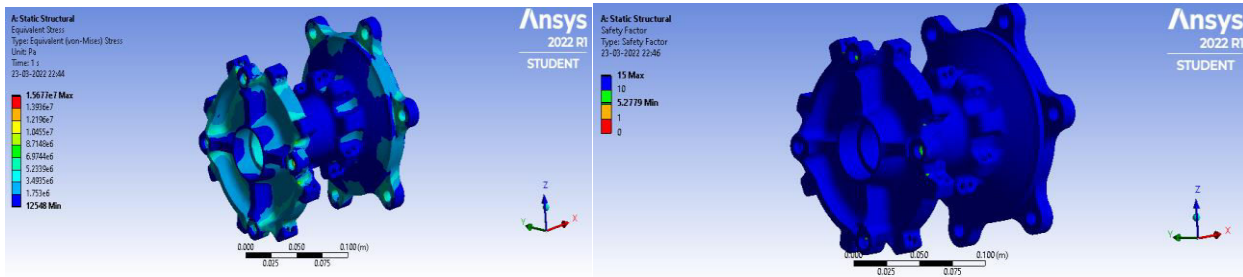
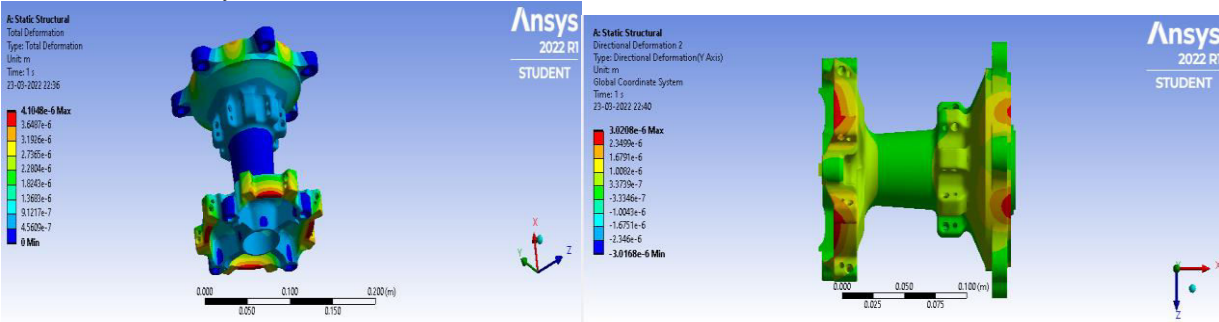




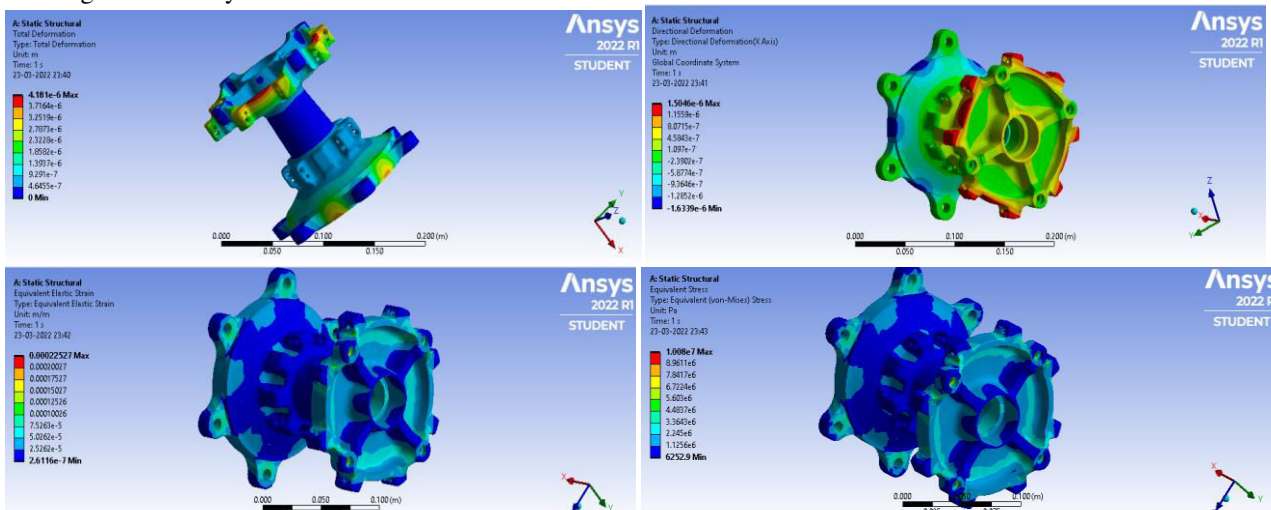
Grey Cast iron



For Aluminium Alloy



For Magnesium Alloy





VI. CONCLUSION

The Analysis is been carried out on Xr 400 Wheel Hub that experience the heavy load factor. The analysis with 5 different materials i.e structural steel, stainless steel, gray cast Iron, Aluminum Alloy, and magnesium Alloy with two different rpms i.e 5000 and 7000. The selection of materials was based on the casted and heavy material properties that with stand high loading conditions. The total deformation was in the order according to the obtained analysis results magnesium< aluminum<structural< stainless steel< gray cast iron the characteristic is because of its density values. The directional deformation in x,y,z axis is shown clearly for the better understand of deformation rate. The Equivalent strain and stress are comparatively nearer for all the materials so all the materials are safe. The safety factor was good for the hub that made of aluminum, magnesium and structural steel will increase the life and gives the strengthen to the hub.

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