Design and Analysis of Cardan shaft

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Abstract— ***A cardan shaft is a rotating shaft that transmits power from the engine to the differential gear of a rear-wheel-drive vehicles cardan shaft must operate through constantly changing angles between the transmission and axle. Because of the continuous rotation, high vibration is occurred on it. Due this problem shaft tends to bend or deform .Major problem in cardan shaft is vibration. The design created in Creo parametric software and analysis using Ansys software. To check the natural frequency based on modal analysis in Ansys software. Finally, it's compared to the various shaft cut-out geometry.***

INTRODUCTION

The joints connect the cardan shaft to the gearbox, which are in charge of distributing torque from the transmission to the driving wheels at a steady pace. A variety of factors might produce vibration in a cardan shaft. Wearing U-joints or slip splines, out-of-balance components, yokes out of phase or misaligned angles, approaching critical speed range, and yoke ears that are not concentric with the splines are all typical causes of driveline vibration.

EXISTING SYSTEM

MR-based four-wheel-drive vehicles and vehicles with a short distance between the engine and axles.

The friction welding used at the junction contributes to the connection's increased strength, quality, and durability.

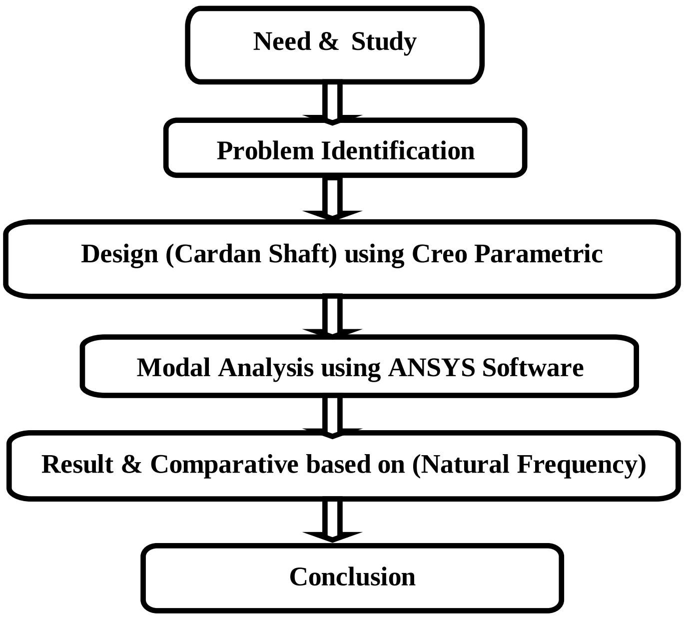
Vehicles with a considerable distance between the engine and the axles, as well as front engine front drive base four-wheel-drive vehicles, use it.

When the cardan shaft is divided into two or three segments, the critical number of revolutions is reduced, which prevents vibration issues when the shaft's overall length is increased.

PROPOSED SYSTEM

Almost all automobiles and locomotives have transmission shafts. The Weight reduction of the cardan (drive) shaft can have a certain role in the general Weight reduction of the vehicle and is a highly desirable goal, if it can be achieved without increase in cost and decrease in quality and reliability. It is possible to achieve design of modified cardan shaft with less weight to Increase the natural frequency of the shaft and to decrease the bending stresses using various stacking sequences.

METHODOLOGY



PROBLEM IDENTIFICATION

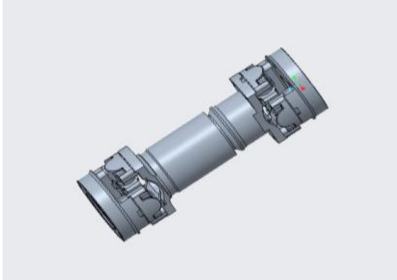
1. 1. Failure of various driveline components can be caused by a variety of factors. Several of them can cause numerous components of a cardan shaft to fail. The terms used to describe common driveline breakdowns are listed below.
2. **Excessive Torque Load**, also known as torsional fatigue, is a prolonged force applied against a driveline component at greater than recommended specs. Excessive torque is usually the result of pulling a heavier load than rated for the vehicle.
3. **Improper Application** is where the driveline components installed are not in-line with the vehicle specs or its purpose.
4. **Critical speed** is the point at which a drive shaft operates at an RPM too high in relation to its length, diameter and mass.

MATERIAL SELECTION

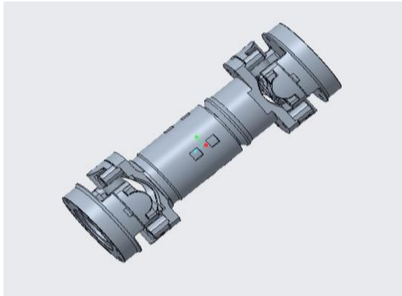
Mild steel, sometimes known as "low carbon steel," is a type of carbon steel that has very little carbon. The quantity of carbon present in mild steel is typically 0.05 percent to 0.25 percent by weight, whereas heavier carbon steels are typically stated as having a carbon content of 0.30 percent to 2.0 percent, depending on the source. If any more carbon was added to the steel, it would be categorized as cast iron.

PRODUCT DESIGN

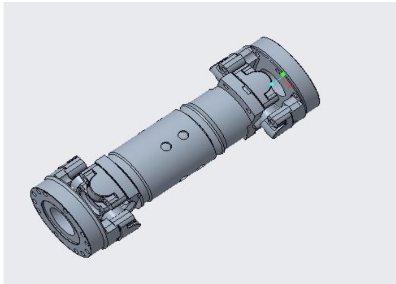
It is not easy to design a product. While businesses may generate a slew of new product ideas, not all of them will be original, profitable, or effective, all of which are critical factors to consider when developing a new product. Product design is the process of creating a new product that is intended to be sold to customers. Developing an idea, determining product feasibility, testing the product, and finally releasing the product for sale to customers are all processes in the product design process. Let's look at each of these processes in more detail.



No Cut



Rectangular cut-out Model

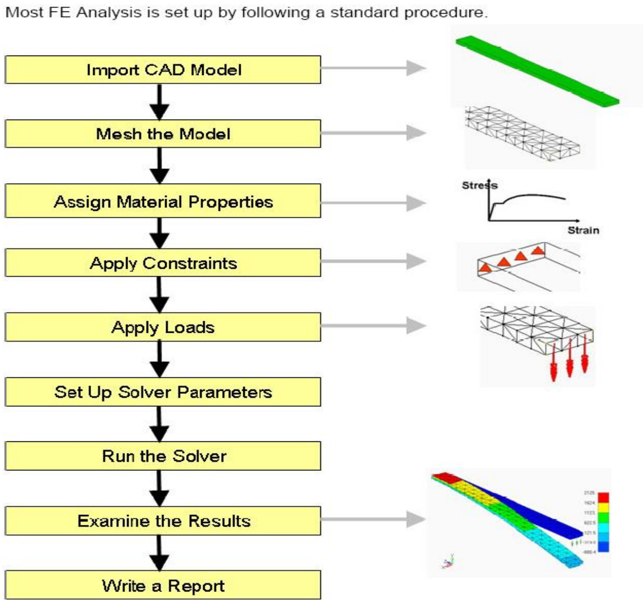


Circular cut-out Model

FINITE ELEMENT ANALYSIS

Finite Element Analysis, or FEA, is the numerical mathematic approach known as the Finite Element Method, or FEM, used to simulate a physical phenomenon. Mechanical engineering, as well as a variety of other fields, rely on this process. It's also one of the main principles for simulation software development. Engineers can utilise these FEM to cut down on the amount of real prototypes needed and undertake virtual experiments to improve their ideas.

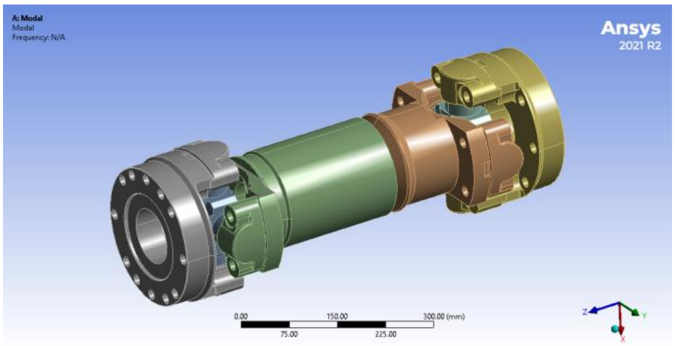
Understanding the physical processes that occur all around us necessitates the use of complex mathematics. These include things like fluid dynamics, wave propagation, and thermal analysis. Analysing most of these phenomena can be done using partial differential equations, but in complex situations where multiple highly variable equations are needed, Finite Element Analysis is the leading mathematical technique.

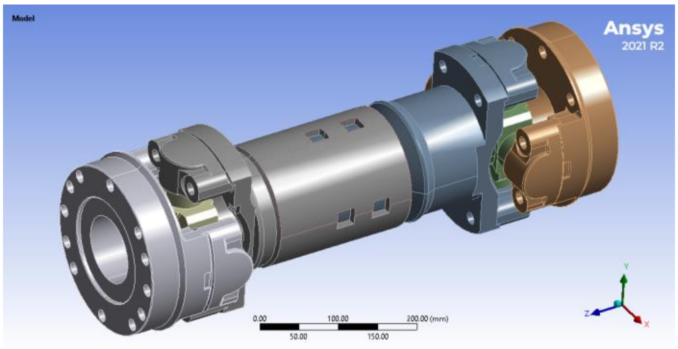


STRUCTURAL ANALYSIS

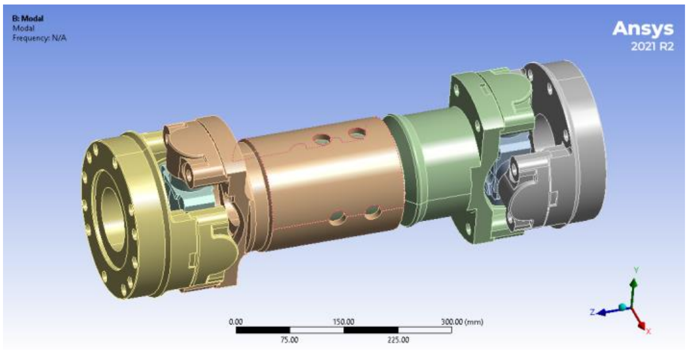
You can tackle difficult structural engineering challenges and make better, faster design decisions with ANSYS structural analysis software. You can tailor and automate solutions for your structural mechanics problems using the suite's finite element analysis (FEA) solvers, and parameterize them to analyse numerous design scenarios. You may also easily connect to other physics analysis tools for even more precision. ANSYS structural analysis software is used by engineers all around the world to help them improve their product designs and lower the expenses of physical testing.

MODEL





Rectangular cut in Shaft



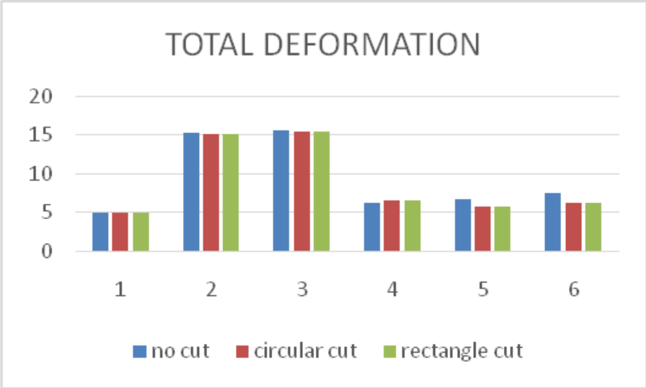
Circular cut in Shaft

CONCLUSION

The Modal Analysis for different cut geometry can conclude the modes of natural frequency analysis on cardan shaft. In this analysis, the different cut geometry shapes according to the maximum frequencies are obtained. After model analysis, all modes according to their deformation & natural frequencies are tabulated respectively. from these results, found that the circular cut geometry model has better vibration results and minimum deformation at same boundary conditions.

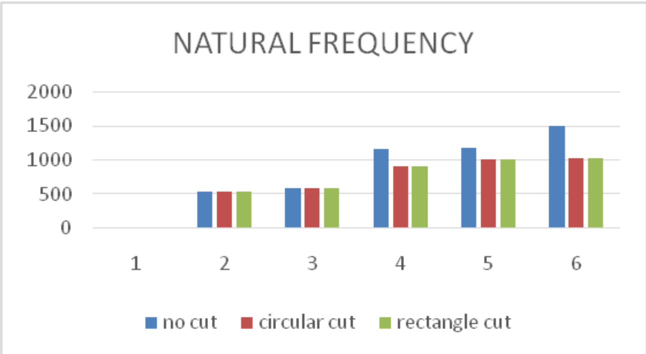
DEFORMATION DETAILS(Hz)

Modes	No-cut	Circular-cut	Rectangle-cut
1	4.9607	4.9691	4.97
2	15.205	15.111	15.108
3	15.615	15.362	15.366
4	6.1307	6.5078	6.5169
5	6.5898	5.6945	5.6966
6	7.4934	6.234	6.232



NATURAL FREQUENCY DETAILS(Hz)

Modes	No-cut	Circular-cut	Rectangle-cut
1	0.0013046	0	0.001352
2	535.65	530.8	530.49
3	589.79	583.78	584.11
4	1162.6	905.93	906.72
5	1174.9	1005.2	1004.7
6	1495.5	1021.5	1022.2



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