Case Study

Design and Analysis of a Gear and Shaft

Aim:

In the case study of gear and shaft analysis the stress of gear on shaft. And in this case chose a two material and compare which material is best to design a gear and shaft.

Introduction to gear and shaft:

What is gear and shaft?

Gear:

Gear and shaft are used in all type of the vehicles. Such as car, bus etc. **Gear** is a toothed machine part, such as a wheel or cylinder, that meshes with another toothed part to transmit motion or to change speed or direction. Gear are two types

1. Gear up
2. Gear down

In first form velocity increase and torque decrease and in the second form the velocity decreased and torque increased.

Shaft:

. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment). In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc., are mounted on it. These members along with the forces exerted upon them causes the shaft to bending.

Advantages of Using gear and shaft

- A shaft is a rotating machine element which is used to transmit power from one place to another
- Gear are used for large reduction in speed and for transmission of torque.
- Using gear systems, we can transmit motion between non-parallel intersecting shafts.
- They are used for positive drive, so its velocity ratio remains constant.

Software used for gear and shaft:

We use **solid works** soft ware for designing and assembly of gear and shaft and after completing this work we use solid works simulation for **stress analysis**.

Steps to Solve a Problem through Solid Works:

1. Build Geometry:

First, we build the geometric 3D model for testing the stress of gear on shaft when The gear are rotating on the shaft.in this analysis of gear and shaft the clamp in which the Shaft is rotating is fixed and gear is rotating on the shaft.

2. Material Properties:

We chose first material alloy steel.

- alloys are considered to be harder, and stronger due to the mixture of elements. –
- Second, alloys are corrosion-resistant, and less malleable in nature.

Property alloy steel:

Property	Value	Units
Elastic Modulus	2.1e+11	N/m^2
Poisson's Ratio	0.28	N/A
Shear Modulus	7.9e+10	N/m^2
Mass Density	7700	kg/m^3
Tensile Strength	723825600	N/m^2
Compressive Strength		N/m^2
Yield Strength	620422000	N/m^2
Thermal Expansion Coefficient	1.3e-05	/K
Thermal Conductivity	50	W/(m·K)

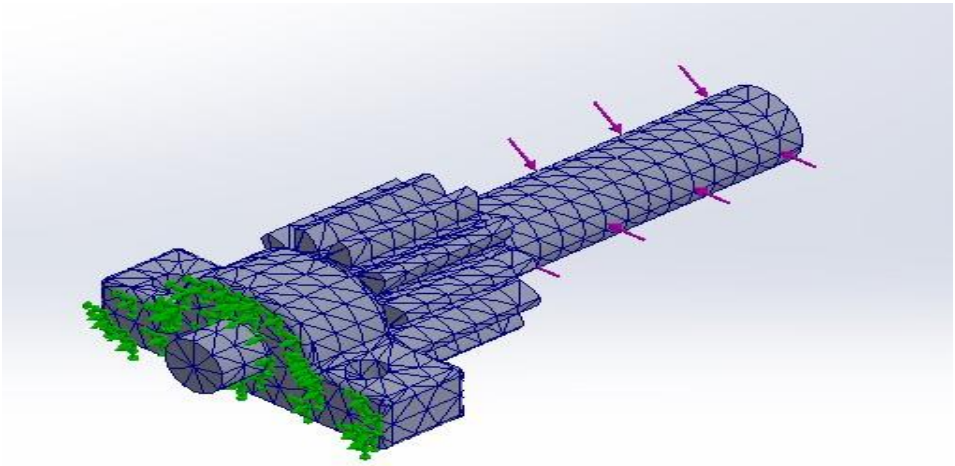
second material beryllium copper:

- Higher resistance to corrosion and oxidation than steel.
- High electrical and thermal conductivity.

Property	Value	Units
Elastic Modulus	1.25e+11	N/m^2
Poisson's Ratio	0.3	N/A
Shear Modulus	5e+10	N/m^2
Mass Density	8250	kg/m^3
Tensile Strength	469000000	N/m^2
Compressive Strength		N/m^2
Yield Strength	172000000	N/m^2
Thermal Expansion Coefficient	1.67e-05	/K

Generate Mesh:

In numerical methods the main difference is an extra step is mesh generation. This is the step which divides the complex model into small elements that becomes solvable in a complex situation. Define how the modeled system should be broken down into finite pieces.



Parameter used for gear and shaft:

shaft

Diameter of the large shaft D1	25mm
Diameter of the medium shaft D2	20mm
Diameter of the small shaft which is inserted into the clamp D3	18mm
L1	95 m
L2	40 m
L3	42 m
shear stress	60 M pa
Torque large shaft	183.98 N-m
Torque medium shaft	94.2 N-m

Torque small shaft	68.67 N-m
Total torque	346.85 N-m
Weight of large shaft W1	346.185 kg
Weight of medium shaft W2	98.59 kg
Weight of small shaft W3	83.84kg
Total W	529.6kg
F	200N

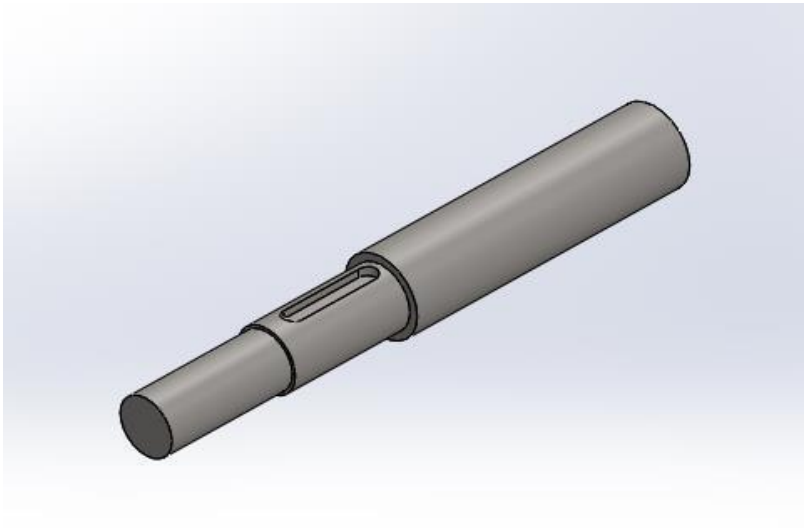
Gear

Pitch	13 mm
Diameter of inner side D1	20 mm
Diameter of outer side D1	52 mm
Number of teeth	12

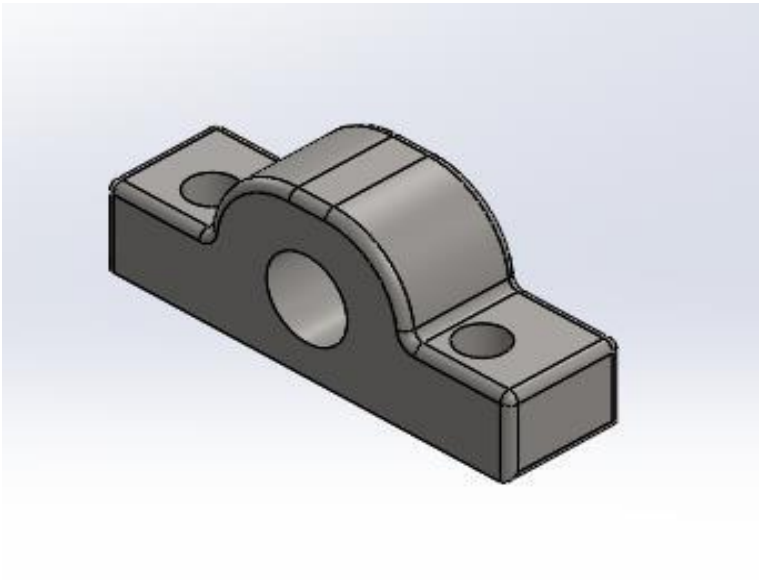
Model of gear and shaft:

Parts of gear and shaft

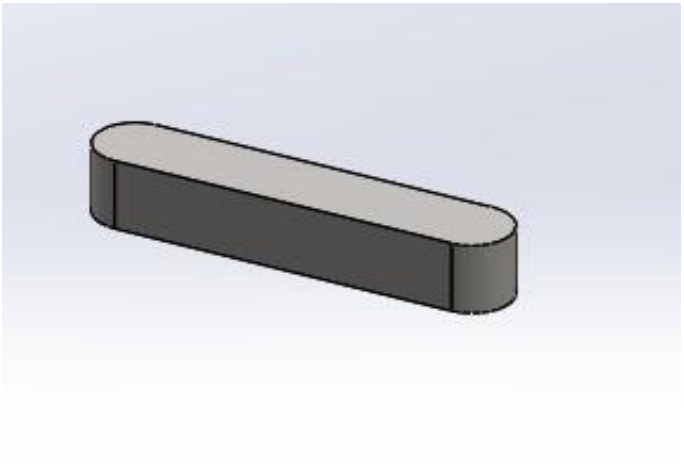
1. **Shaft**



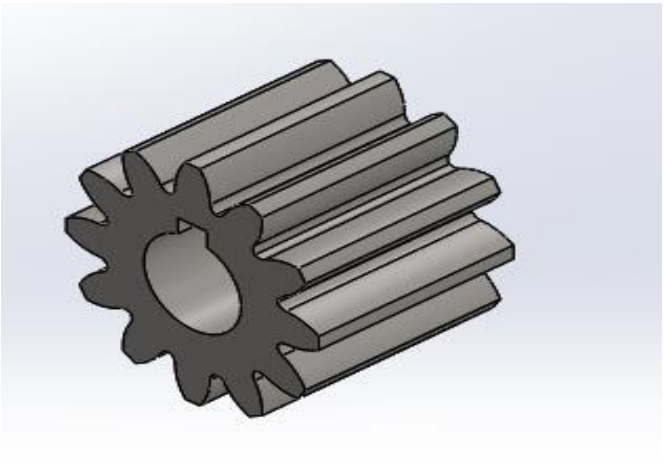
2. **clamp**



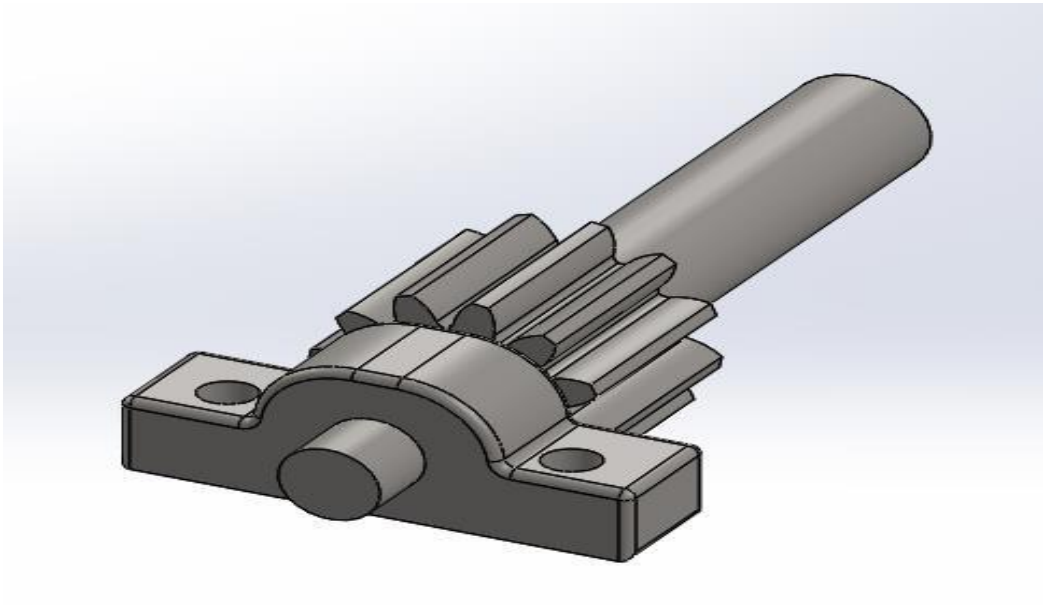
3. **Key**



4. **Gear**



5. **Assembly of gear and shaft:**



UNIVERSITY OF ENGINEERING AND TECHNOLOGY LAHORE

FAISALABAD CAMPUS

Case study of Design Of machine Element Gear and Shaft

SUBMITTED BY:

Arham Ali Khan
Faizan Ali Matloob
Umair Akbar Khan
Hanzla Munir

REGISTRATION No:

2019-MC-253
2020R2019-MC-297
2020-MC-301
2020-MC-307

SUBMITTED TO: Dr Asim Ghaffar