Project Description

• Modifying an old torsion test setup

What Is Torsion Test

![Torsion Test Diagram]

Component of the Torsion Test Setup

1. Main body
2. Big gear
3. Small gear
4. New specimen
5. Old torque arm
6. Pin for big gear
7. Pin for small gear
8. Torque shaft
9. Pin for torque shaft
10. Small gear shaft
11. Pin for specimen
12. Pin for specimen
13. 14. Connection part of new torque arm
15. New torque arm
16. 17. Pin for specimen
18. 19. Connection part of new torque arm

Failure of material under torsion

Ductile materials fail in shear when subjected to torsion. Specimens will break along a plane perpendicular to the longitudinal axis.

Bbrittle materials generally fail in tension rather than in shear. When subjected to torsion, a specimen tests to break along a plane which are perpendicular to the direction in which tension is maximum.

![Ductile and Brittle Failure Diagram]

Ductile material is used in this project (aluminium 7075)
So tests should give similar shape results

Problems of the Old Setup:

- Not working
- Lack of specimen
- Tests cannot be made properly
- The results are not suitable
- Specimens are not designed for the setup

Objective

The objective of this project is to modify the old test setup and make it work properly.
To achieve this objective, steps which are on bellow were followed.

- Design two new specimen
- Build it by using a lathe
- Break them and decide which design to use
- Prepare its technical drawing on Solidworks
- Produce 8 different specimens by using a CNC
- Test them, and record those tests
- Get the Shear stress-strain graphs
- Coat the main body for corrosion
- Produce 50 different specimens for future tests

In this project, aluminium (Alloy 7075) is used. The material property of aluminium 7075 is on bellow.

Engineering Design And Production Processes

These are the steps followed on design and production

1. Design the part on solid works
2. Clean the surface and points of the specimen
3. Opening the center point to fix the part to the turning lathe
4. Cutting the specimen on the turning lathe
5. Example of an actual specimen
6. Alternative specimen design
7. Alternative specimen design

What is happening on an actual test?

Using a high speed camera, these steps are captured.

So at the beginning, there is no torque applied to the specimen. The black line can be seen as linear.

Then torque started to apply to the specimen. In this picture, the specimen is still in the elastic region, so the torque applied removed, the specimen return back to its original shape, which can be seen from the picture above.

Finally, this is the last step that the specimen came. This picture is just taken before the fracture(0.01 second before the fracture).

So, when torque is applied to the specimen, the specimen deforms and the breaks.

Results

8 different tests have been made and 3 of them have been recorded. The Stress – Strain Graph for those 3 tests are on bellow

![Stress-strain Graph]

As seen from above, max shear stress occurs on the surface of the material, so the fracture happens on the surface

References: