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Design & Analysis of Strength Check Analysis for Gear Shaft



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ABSTRACT:

Gear is a toothed wheel that works with others to alter the relation between the speed of a driving mechanism and the speed of the driven parts. Geared devices can change the speed, torque, and direction of a power source. The most common situation is for a gear to mesh with another gearSpur gears are the most common type of gears. They have straight teeth, and are mounted on parallel shafts. Sometimes, many spur gears are used at once to create very large gear reductions. This is because the spur gear can be really loud. Each time a gear tooth engages a tooth on the other gear, the teeth collide, and this impact makes a noise. It also increases the stress on the gear teeth.

By increasing stress resulting gear life will be decreases. In this project we will try to improve strength of gear. For increase strength of gear we want to replace gear materials is option without design changes. Gears are made with high tensile strength materials. In this way we are searching high tensile strength materials for improve and replacement. This project going with CAD /CAM base. Gear profile designed and model done using of Pro/engineer. Structural analysis done using Ansys software.

INTRODUCTION TO GEARS:

A gear is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part in order to transmit torque. Two or more gears working in tandem are called a transmission and can produce a mechanical advantage through a gear ratio and thus may be considered a simple machine.

Geared devices can change the speed, magnitude, and direction of a power source. The most common situation is for a gear to mesh with another gear, however a gear can also mesh a non-rotating toothed part, called a rack, thereby producing translation instead of rotation.The gears in a transmission are analogous to the wheels in a pulley. An advantage of gears is that the teeth of a gear prevent slipping.

When two gears of unequal number of teeth are combined a mechanical advantage is produced, with both the rotational speeds and the torques of the two gears differing in a simple relationship.In transmissions which offer multiple gear ratios, such as bicycles and cars, the term gear, as in first gear, refers to a gear ratio rather than an actual physical gear.

The term is used to describe similar devices even when gear ratio is continuous rather than discrete, or when the device does not actually contain any gears, as in a continuously variable transmission.

The earliest known reference to gears was circa 50 A.D. by Hero of Alexandria, but they can be traced back to the Greek mechanics of the Alexandrian school in the 3rd century BC and were greatly developed by the Greek polymath Archimedes (287-212 BC).

TYPES OF GEARS:

MESHED MODEL:

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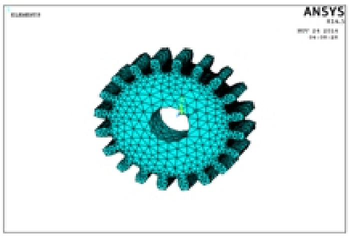
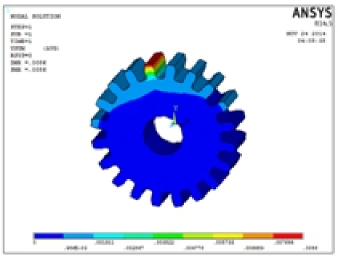


Loads
Pressure – 20.325 MPA

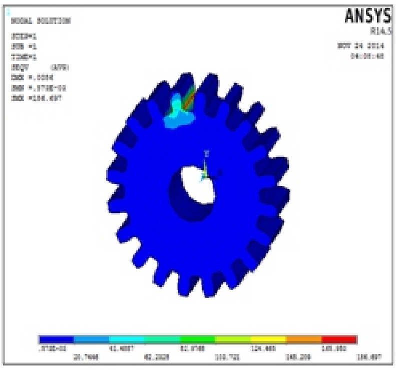
Displacement



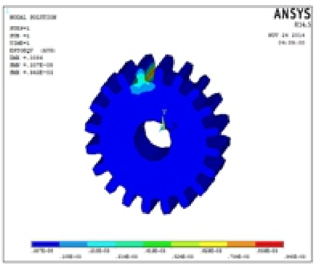
Solution
Solution – Solve – Current LS – ok
Post Processor
General Post Processor – Plot Results – Contour Plot - Nodal Solution – DOF Solution – Displacement Vector Sum

STRESS

General Post Processor – Plot Results – Contour Plot – Nodal Solution – Stress – Von Mises Stress



General Post Processor – Plot Results – Contour Plot – Nodal Solution –strain- total vonmises strain

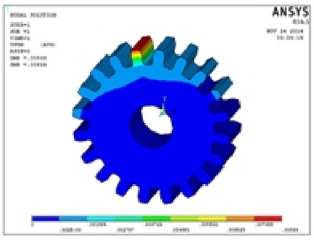


ALUMINUM 514

MATERIAL PROPERTIES

Element Type: Solid 20 node 95
Material Properties: Youngs Modulus (EX) : 205 GPA
Poissons Ratio (PRXY) : 0.29
Density :7.85e-6
Load
Pressure – 20.325 MPA

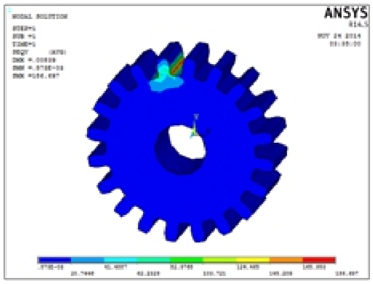
Displacement



Solution
Solution – Solve – Current LS – ok
Post Processor
General Post Processor – Plot Results – Contour Plot - Nodal Solution – DOF Solution – Displacement Vector Sum

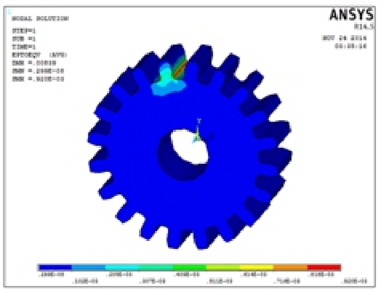
STRESS

General Post Processor – Plot Results – Contour Plot – Nodal Solution – Stress – Von Mises Stress



STRAIN

General Post Processor – Plot Results – Contour Plot – Nodal Solution –strain- total vonmises strain



ALLUMINIUM 4337

MATERIAL PROPERTIES

Element Type: Solid 20 node 95

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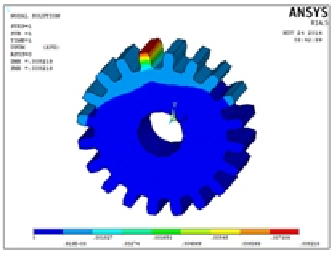
Material Properties: Youngs Modulus (EX) : 209 GPA
Poissons Ratio (PRXY) : 0.30
Density :7.75 e-6
Load
Pressure – 20.325 MPA

Displacement



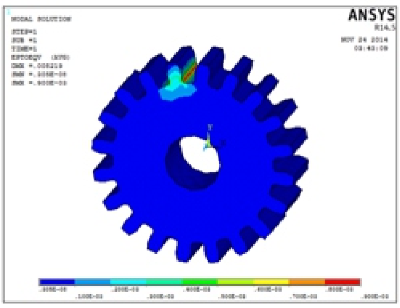
Solution
Solution – Solve – Current LS – ok
Post Processor
General Post Processor – Plot Results – Contour Plot - Nodal Solution – DOF Solution – Displacement Vector Sum

STRESS

General Post Processor – Plot Results – Contour Plot – Nodal Solution – Stress – Von Mises Stress

STRAIN

General Post Processor – Plot Results – Contour Plot – Nodal Solution –strain- total vonmises strain



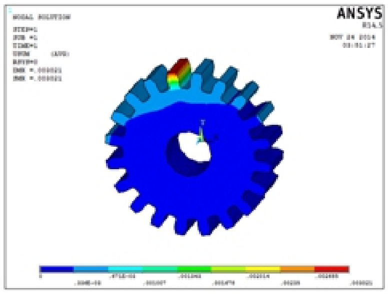
TUNGSTUN CARBIDE

Element Type: Solid 20 node 95
Material Properties: Youngs Modulus (EX) : 572 GPA
Poissons Ratio (PRXY) : 0.23
Density :7.75 e-6

MESHED MODE

Load
Pressure – 20.325 MPA

Displacement



Solution
Solution – Solve – Current LS – ok
Post Processor
General Post Processor – Plot Results – Contour Plot - Nodal Solution – DOF Solution – Displacement Vector Sum

RESULTS & TABLES
STRUCTURAL ANALYSIS

	DISP mm	STRESS N/mm²	STRAIN
A-36	0.0086	186.697	0.943E^{-6}
ALUMINUM 514	0.00839	186.697	0.929E^{-6}
ALLUMINIUM 4337	0.008219	186.186	.900E^{-03}
TUNGSTUN CARBIDE	0.003021	190.156	0.336E^{-6}

Conclusion:

This can lead to various benefits including reduction in redundancies, cost containment related to adjustments between manufacturers for missing part interchangeability, and performance due to incompatibility of different standards. From the study of effect of various parameters (viz.bending stress, dynamic tooth load, beam strength) on the optimum design of helical gears for marine applications, the induced bending stresses are much lower than those of the results obtained theoretically

Also the bending stresses are much lower than the design stresses, thus the design is safe from the structural point of view. It is observed that the induced bending stresses Design & Analysis of a Spur Gear in different Geometric Conditions 13 are less than that of the theoretical calculations. Aluminum alloy reduces the weight up to 55-67% compared to other materials like steel. Weight reduction is a very important criterion, in order to minimize theunbalanced forces setup in the marine gear system, there by improves the system performance. The helical gear parameters that constitute the design are found to be safe from strength and rigidity point of view.

Hence Aluminum alloy may be best possible material for marine gear in the high speed applications. The alloys are produced mainly as sheet and plate and only occasionally as extrusions. The reason for this is that these alloys strain harden quickly and, are, therefore difficult and expensive to extrude. Present day competitive business in global market has brought increasing awareness to optimize gear design. Current trends in engineering globalization require results to comply with various normalized standards to determine their common fundamentals and those approaches needed to identify “best practices” in industries.