# 3D Modeling Project #17

GEARS

Gears are an assembly of wedges that transfer energy smoothly. Gears are fascinating.

Before You Start

Go to the Creative Suite, open a new PLaSM project, and save it as Project-17 in the folder course-3D-projects/.

Project Goal

The goal of this project is to create a working arrangement consisting of at least two gears. The world of gears is amazing.
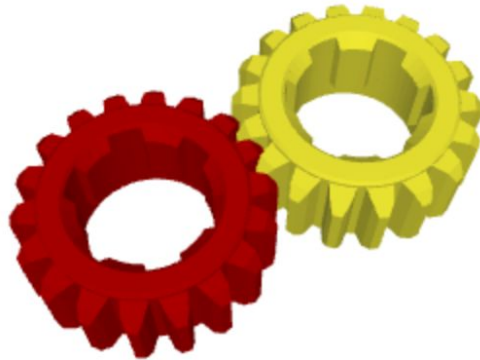
The function of a gear is to reduce or increase the angular speed of rotating parts, or even transform rotation into a linear motion. The objective of this project is to create a system of at least two gears that works when 3D printed! Read about different types of gears below and make your choice. While designing your gears, keep in mind that all parts must be sufficiently loose to turn, but not too loose to fall apart. You will also need to design a box or at least a simple base plate to position the gears correctly.

Types of Gears

There are nine basic types of gears:

1. Spur Gear
2. Helical Gear
3. Herringbone Gear
4. Bevel/Miter Gear
5. Worm Gear
6. Rack and Pinion
7. Internal and External Gear
8. Face Gear
9. Sprockets

We will show an example of each one below.

Spur Gear

Spur gears have straight teeth and are parallel to the axis of the wheel. Spur gears are the most common type of gears. The advantages of spur gears are their simplicity in design, economy of manufacture and maintenance, and absence of end thrust. They impose only radial loads on the bearings. Spur gears are known as slow speed gears. If noise is not a serious design problem, spur gears can be used at almost any speed.

Helical Gear

Helical gears have their teeth inclined to the axis of the shafts in the form of a helix, hence the name helical gears. These gears are usually thought of as high speed gears. Helical gears can take higher loads than similarly sized spur gears. The motion of helical gears is smoother and quieter than the motion of spur gears. Single helical gears impose both radial loads and thrust loads on their bearings and so require the use of thrust bearings. The angle of the helix on both the gear and the must be same in magnitude but opposite in direction, i.e., a right hand pinion meshes with a left hand gear.

Herringbone Gear

Herringbone gears resemble two helical gears that have been placed side by side. They are often referred to as "double helicals". In the double helical gears arrangement, the thrusts are counter-balanced. In such double helical gears there is no thrust loading on the bearings.

Bevel/Miter Gear

Intersecting but coplanar shafts connected by gears are called bevel gears. This arrangement is known as bevel gearing. Straight bevel gears can be used on shafts at any angle, but right angle is the most common. Bevel Gears have conical blanks. The teeth of straight bevel gears are tapered in both thickness and tooth height. For example, in these **Spiral Bevel gears,** the teeth are oblique. Spiral Bevel gears are quieter and can take up more load as compared to straight bevel gears.

Zero Bevel gears are similar to straight bevel gears, but their teeth are curved lengthwise. These curved teeth of zero bevel gears are arranged in a manner that the effective spiral angle is zero.

Worm Gear

Worm gears are used to transmit power at 90° and where high reductions are required. The axes of worm gears shafts cross in space. The shafts of worm gears lie in parallel planes and may be skewed at any angle between zero and a right angle.In worm gears, one gear has screw threads. Due to this, worm gears are quiet, vibration free and give a smooth output.Worm gears and worm gear shafts are almost invariably at right angles.

The image below shows a worm gear as a tuning mechanism that is present on guitars, ukuleles, violins, and other string instruments.

Rack and Pinion

A rack is a toothed bar or rod that can be thought of as a sector gear with an infinitely large radius of curvature. Torque can be converted to linear force by meshing a rack with a pinion: the pinion turns; the rack moves in a straight line. Such a mechanism is used in automobiles to convert the rotation of the steering wheel into the left-to-right motion of the tie rod(s). Racks also feature in the theory of gear geometry, where, for instance, the tooth shape of an interchangeable set of gears may be specified for the rack (infinite radius), and the tooth shapes for gears of particular actual radii then derived from that. The rack and pinion gear type is employed in a rack railway.

Internal and External Gear

An *external gear* is one with the teeth formed on the outer surface of a cylinder or cone. Conversely, an *internal gear* is one with the teeth formed on the inner surface of a cylinder or cone. For bevel gears, an internal gear is one with the pitch angle exceeding 90 degrees. Internal gears do not cause direction reversal.

Face Gear

Face gears transmit power at (usually) right angles in a circular motion. Face gears are not very common in industrial application.
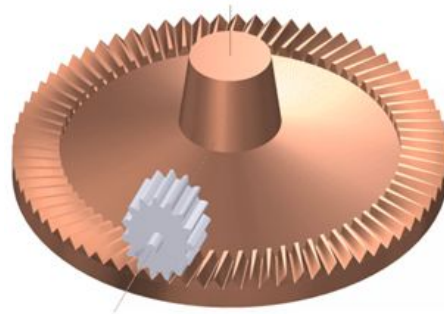
Sprockets

Sprockets are used to run chains or belts. They are typically used in conveyor systems.

Project Checklist

Your project will be finished when:

1. You have finished your 3D model that includes at least two interacting gears.
2. Your program is saved as Project-17 in folder course-3D-projects/.