

## Final Lab: Gear tooth stresses

You will draw a gear pair using the spur gear tool in Fusion 360. Your gear will have 16 teeth that are milled, and a diametral pitch of 8 and a pressure angle of  $\phi = 20^\circ$ . The face width will be 1.5 inches. Make the bore hole 1". The gear is meant to operate at 1200 rpm. It is made from AISI 1020 in the as-rolled condition with a yield strength of 30kpsi. For a factor of safety of 3 against yield, the maximum tangential force the gear tooth can carry is 365lb and the max horsepower is 6.95HP.

Your tasks are, as follows:

- 1.) Use fusion 360 to CAD an identical pair of the described gears. You will separate the centers by the pitch circle diameters to create a pair of gears with tooth contact at the pitch point.
- 2.) You will constrain the interior bore of one of the gears ( the left one) to prevent translation and rotation. The other gear will only be constrained to prevent translation (a pin constraint).
- 3.) Along the line of centers you will identify a tooth on the gear that you will permit to rotate. You will apply a tangential load of 365lbf at the tip of that tooth. This gear should rotate into contact with the 'fixed' gear.
- 4.) You will use Fusion 360 FEA to find the stresses in the gear teeth, including the root stress of the gear tooth to which you are applying the tangential load, and the root and contact stress for a gear tooth in mesh.
- 5.) You will use the Lewis bending stress formula to find the root stress and compare with the results from Fusion.
- 6.) You will modify the Lewis bending stress using a root SCF , and compare this stress to the FEA stress. You will find the fillet radius for the tooth using the inspection tool in fusion.
- 7.) Write a report that explains your results.