Gearing Design Tips

Pump Studios

Start with the Goal in Mind:

Define your input and output requirements to start. How much torque will be imparted on the system? What is the required output speed? What type of input do you plan to use?

Consider Space Limitations Early:

Available space will heavily influence the type, size, and arrangement of the gear train.

Use Standard Gear Profiles:

Standard gear tooth specifications keep manufacturing simple and cost effective. If possible, design around off the shelf parts.

Know your Reduction Limits:

Don’t greatly exceed the reduction guidelines for each stage. This could result in noisy, inefficient, or compromised systems. (ex. Spur - 5:1, Helical - 10:1)

Check Gear Strength:

Use the Lewis equation ($\sigma = Wt*P / F*Y$) as a starting place. Consider key factors like material, size (gear module), number of teeth, and face width

Evaluate Forces within the System:

Each gear must be constrained properly to manage all possible forces. For example, helical gears generate axial forces.

Pick Materials Intentionally:

For each gear, think about durability, manufacturability, and noise. Pinion gears typically wear faster so they should be made from harder materials.

Minimize Noise:

Gear type, material, contact ratio, bearing type, and lubrication should all be taken into account. We found that using helical gears and plastics had a significant effect.

Give Your Gears “Hunting Teeth”:

Choose tooth counts that don’t share common factors (ideally prime numbers) to ensure even wear over time.

Don’t Sweat the CAD:

If you’re using standard specifications, you don’t need to reinvent the ~~wheel~~ gear and model involute gears from scratch. Instead, provide key dimensions like pitch and outer diameter and notate the gear specs. When you need printable 3D models, you can use online tools to generate them.