MTE 322 Project One Report

Angle Grinder Power Tool

Prepared By:
Nolen Zhao
20932971

1 Introduction

2 Assumptions

The following solutions are under the assumption that the F_{xz} is the maximum force that the angle grinder can output. If an external force equal to and opposite of F_{xz} is applied at the contact point, then the angle grinder will not be able to spin. It is also assumed that the force F_y is the normal force on the angle grinder applied by the user.

3 Question One

The general expressions for all contact forces of the gears and bearings is found with respect to β, as that is the only variable present. The value of β will affect the output torque, and propagates through the calculations for forces. This will be shown below.

First, the output torque as a function of β is found. The distance from the contact point to the centre of the shaft is given to be $\frac{4r}{5}$ where r is the radius. The z component of force, perpendicular to the distance from the radius, can be represented below in Equation 1.

$$F_{xz} \cdot \cos(\beta) \tag{1}$$

F_{xz} is given as $30N$, so the force at the contact point is $30N \cdot \cos(\beta)$. Thus, the torque can be found below in Equation 2 where the radius was given in the SolidWorks assembly as $55mm$.

$$\tau = F_{xz}\cos(\beta) \cdot \frac{4r}{5} = 30N \cdot \cos(\beta) \cdot \frac{4 \cdot 0.055m}{5} = 1.32 \cdot \cos(\beta)Nm \tag{2}$$

The rotational velocity is given as $n = 2550rpm$, and should be converted into units of rad/s for calculations. The conversion is shown below in Equation 3

$$\omega = n \cdot \frac{2\pi rad}{1rev} \cdot \frac{1min}{60s} \rightarrow 2550rpm \cdot \frac{2\pi rad}{1rev} \cdot \frac{1min}{60s} = 267.035rad/s \tag{3}$$

The equation for power and ensuing output power is found below in Equation 4

$$\mathbb{P} = \omega \cdot \tau \rightarrow \mathbb{P}_{output} = 267.035rad/s \cdot 1.32 \cdot \cos(\beta)Nm = \tag{4}$$

4 Question Two