# Notes on Cycloidal Drives

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# 1 Design of Cycloidal Disc

## 1.1 Cycloidal Disc

- Cycloidal shape obtained by rolling circle that rolls around a base circle
- Cycloid corresponds to path described by a point at the circumference of the rolling circle (ordinary cycloid)
- Diameter of fixed pins will correspond w/ diameter of drawing circle used to actually make cycloid
- Will likely want contracted cycloid to decrease eccentricity and unbalanced forces at high speeds (r < R)
- Due to symmetrical load distribution, two cycloidal discs are often used and offset by 180°

## 1.2 Transmission Ratio

$$TransmissionRatio = i = \frac{n}{N-n} \tag{1}$$
$$where, N = 1 + n \tag{2}$$

- $n$ = # of rotor teeth
- $N$ = # of rollers

$$i = \frac{d}{\delta} \tag{3}$$
$$\delta = \frac{D}{N} \tag{4}$$
$$d = \frac{i}{N}D \tag{5}$$

- $\delta$ is the diameter of the rolling circle
- $d$ is base circle diameter
- $D$ is the pitch circle of the fixed diameter pins
- $N$ is the # of fixed pins

## 1.3 Eccentricity

$$e \leq \frac{\delta}{2} \tag{6}$$

- If $e$ is too small, the shape of the cycloid will become too soft and get close to a circle
- This can cause increasing backlash

### 1.4 Hole diameter of the cycloidal disc

$$d_h = d_r + 2e \tag{7}$$

- $d_h$ is the diameter of holes in the cycloidal disc
- $d_r$ is the diameter of the roller pins

## 2 Epitrochoid

An epitrochoid is a roulette traced by a pt attached to a circle of radius $r$ rolling around the outside of a fixed circle of radius $R$. The point is at a distance $d$ from the center of the exterior circle. The parametric equations are as follows:

$$x(\theta) = (R + r)\cos\theta - d\cos(\frac{R+r}{r}\theta) \tag{8}$$

$$y(\theta) = (R + r)\sin\theta - d\sin(\frac{R+r}{r}\theta) \tag{9}$$

## 3 References


1. Construction of Cycloidal Disc
2. Thesis involoving cycloidal drives
3. Thesis with Dual Stage cycloidal drive
4. Cycloidal drive design and printing
5. Cycloidal drive in Solidworks
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7. Wiki page on Epitrochoid
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