Published on *Mechanical Engg Simple Notes ,Solved problems and Videos* (https://mechdiploma.com)

Law of gearing

Question:
State and explain Law of Gearing.

Answer:

Law of Gearing

Law of gearing states that the common normal at the point of contact between a pair of teeth must always pass through the pitch point for all positions of mating gear. This law forms the basis for the gear profile design. This is a must condition for the two gears to perform properly.
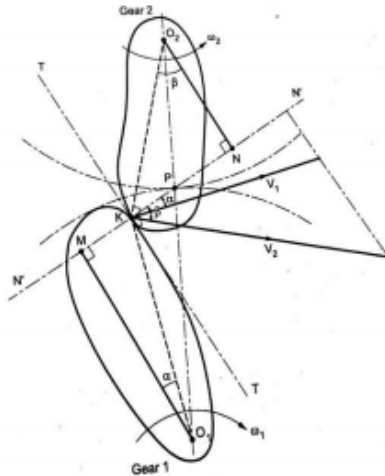
Law of gearing Proof

Consider the portions of two gear teeth in mesh.o1 and o2 are centre points,

Let K= point of contact

TT = COmmon tangent at the point of contact K

N'N' = common tangent at the pont of contact K

O1m and O2N are perpendicular to common normal N'N'.

Consider the portions of two gear teeth in mesh. O_1 and O_2 are centre points.
Let K = point of contact
T T = Common tangent at point of contact K
N'N' = Common Normal at point of contact K
O_1M and O_2N are perpendicular to Common Normal N'N'.

V_1 and V_2 = Velocities at point K w. r. t. gear 1 and 2 respectively
If mating teeth to remain in contact while transmitting motion, components of velocities must be equal along N'N'.
So, $V_1 \cos \alpha = V_2 \cos \beta$
$(\omega 1 \times O1K) \cos \alpha = (\omega 2 \times O2K) \cos \beta$
From triangles O1MK and O2NK putting values of $\cos \alpha$ and $\cos \beta$

$$\omega_1 \times O_1K \times \frac{O1M}{O1K} = \omega_2 \times O_2K \times \frac{O2N}{O2K}$$

$\omega_1 \times O_1M = \omega_2 \times O_2N$

$$\frac{\omega 1}{\omega 2} = \frac{O2N}{O1M} \qquad \ldots\ldots\ldots\ldots(1)$$

Since O_1MP and O_2NP are similar triangles.

$$\frac{O2N}{O1M} = \frac{O2P}{O1P} \qquad \ldots\ldots\ldots\ldots(2)$$

From equations (1) and(2) , we get

$$\frac{\omega 1}{\omega 2} = \frac{O2P}{O1P}$$

From this, it is proved that angular velocity ratio is inversely proportional to ratio of distance of fixed point 'P' ,which is pitch point. This gives constant angular velocity ratio.

In other words, the common normal at the point of contact between a pair of teeth must always pass through the pitch point for all positions of mating gears. This is the fundamental condition which must be satisfied while designing the profiles of teeth for gears. This is Law of Gearing or Condition of correct gearing.

Law of gearing animation

As shown in the diagram below the common normat at the point of contact between a pair of teeth must always pass through the pitch point for all positions of mating gears.

This is the fundamental condition which must be satisfied while designing the profiles of teeth for gears.

This law is must for a gearing pair to perform properly. The animation clearly demonstrates the blue line which traces the path of the point of contact.

Link to other topics of Theory of machines is given below.

- [Unit-1-Fundamentals and type of mechanisms](#)
- [Unit-2-Velocity and Acceleration in Mechanisms](#)
- [Unit-3-Cams and Followers](#)
- [Unit-4-Belt,Chain and Gear Drives](#)
- [Unit-5-Brakes and Clutches](#)
- [Unit-6-Flywheel,Governor and Balancing](#)
- [Question Paper And Solution](#)