**SERVO DRIVELINE TRANSMISSION AND FAULT MATHEMATICAL MODEL**

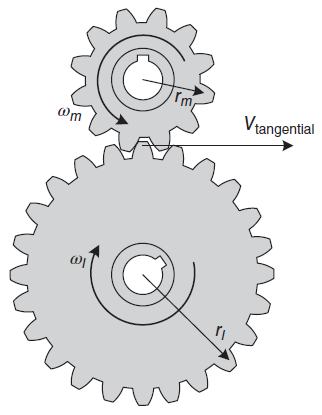
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**Basic Mechanical Relations for Gear System**

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(Inertia defines the resistance of an object to change in its angular velocity about an axis of rotation. Inertia opposes change in motion.)

**Gear Box ratio:**

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**Fig.1:** Gear Mesh System

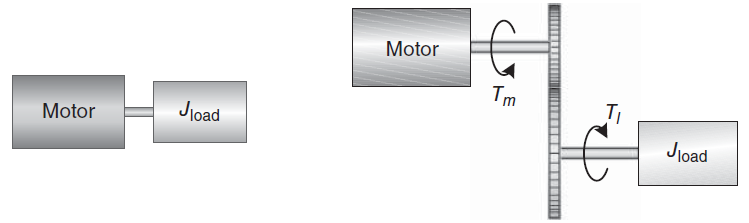
The tangential speed equation:

Power related equation:

If we assume the efficiency of the system 100% :

**Reflected Inertia**

The reflected inertia is seen by the motor, changes when the load is coupled to the motor through a **direct coupling** or **gear box**.



(a) Direct drive (b) Gear box drive

**Fig. 2:** Reflected inertia and torque for (a) Direct drive system, (b) Gear box drive system

Direct drive:

Gear box drive:

For a gear box drive system, when the gears rotate, the distance traveled along the circumference of each gear is the same and given by:

If we differentiate both sides twice:

Solving the equation for and substituting into gives:

Load inertia reflected to the motor through the gears:

**Total Inertia:**

Where,

**Reflected Torque**

Power related equation:

We can write:

**Fault on the Tooth of the Gear System**

Assumption for Broken tooth model:

Broken tooth don’t stop the motion. Free moment of inertia continues the motion (there is no locking or complete disconnection)

Speed increases, torque decreases

