MMAN2300
Engineering Mechanics 2

Part A: Week 4

Method of instant centres

(Chapter 5/5 Meriam & Kraige,
Chapter 4 Waldron & Kinzel)

4. Conservation of Power and Energy

   The analysis is based on the assumption that the input power equals the output power.

   i.e., $P_{in} = P_{out}$

   This is valid if

   (i) no energy losses in the mechanism, and
   (ii) no energy stored in the system as it moves

$$P = T\omega = Fv$$

$$\Rightarrow \frac{T_{in}}{T_{out}} = \frac{\omega_{out}}{\omega_{in}} \qquad or \qquad \frac{F_{in}}{F_{out}} = \frac{v_{out}}{v_{in}}$$

   The ratio of (angular) velocities can be determined using the instant centre method.

5. Mechanical Advantage (*M.A.*)

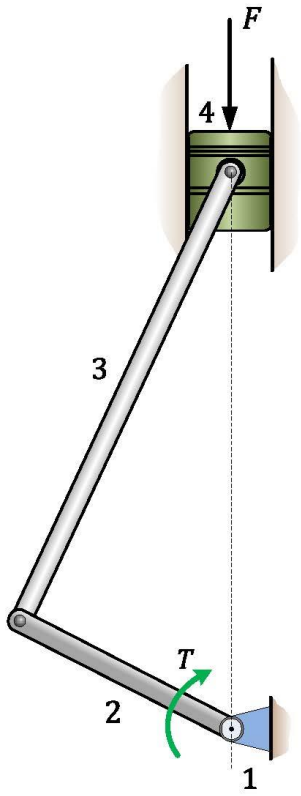
   Mechanical advantage (*M.A.*) is defined as the ratio of the magnitudes of output force over input force.

$$M.A. = \frac{F_{out}}{F_{in}}$$

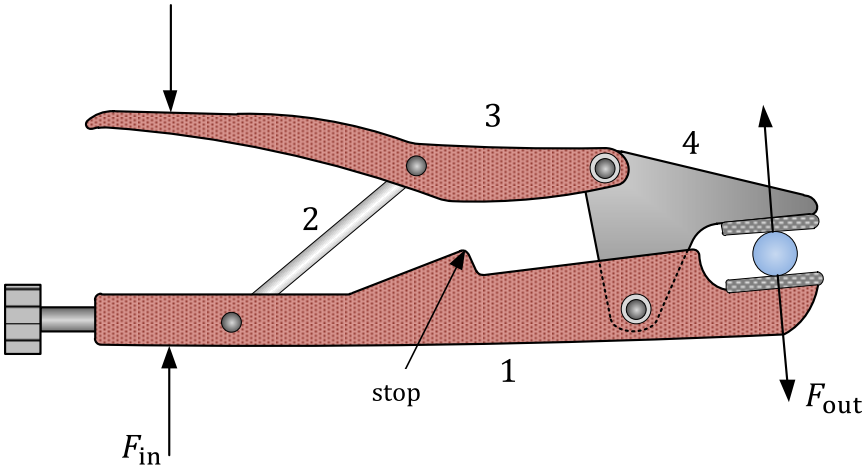
   M.A. is a non-dimensional positive number.

Example

(a) Find torque T required to supply piston force F (assuming $P_{in} = P_{out}$).



(b) Determine the mechanical advantage of the adjustable toggle pliers.



(c) Determine the mechanical advantage for the mobile lifting mechanism shown below. A graphical solution is acceptable.