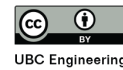
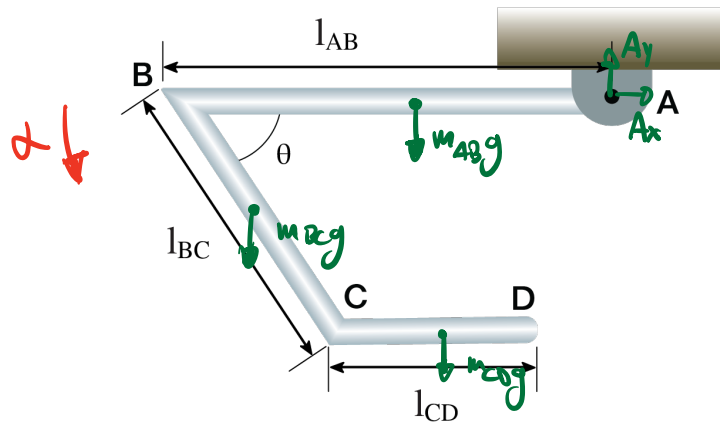
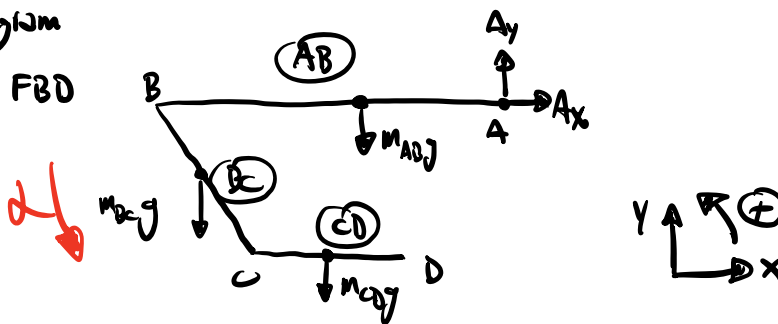


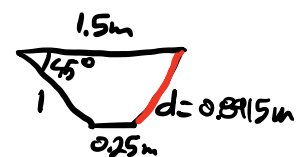
Three slender rods with equal mass are welded together. If the assembly is released from rest, what is the angular acceleration of the rods? The rods have a mass of $m = 2\text{ kg}$ each. Rod AB has a length $l_{AB} = 1.5\text{ m}$, rod BC has length $l_{BC} = 1\text{ m}$, and rod CD has length $l_{CD} = 0.5\text{ m}$. Initially, rod AD and rod CD are perfectly horizontal. Rod BC forms an angle of $\theta = 45\text{ deg}$ with rod AB.



① Diagram



$$\sum M_A = I_A \alpha$$



$$I_{AB} = \frac{1}{12} m l^2 + m d^2 = \frac{1}{12} (2\text{ kg}) (1.5\text{ m})^2 + (2\text{ kg}) (0.75\text{ m})^2$$

$$I_{BC} = \frac{1}{12} m l^2 + m d^2 = \frac{1}{12} (2\text{ kg}) (1\text{ m})^2 + (2\text{ kg}) (1.1997\text{ m})^2$$

$$I_{CD} = \frac{1}{12} m l^2 + m d^2 = \frac{1}{12} (2\text{ kg}) (0.5\text{ m})^2 + (2\text{ kg}) (0.8915\text{ m})^2$$

$$I_A = I_{AB} + I_{BC} + I_{CD} = \underline{11.2758 \text{ kg m}^2} = I_A$$

$$\sum M_A = I_A \alpha \Rightarrow m_{AB} g (0.75 \text{ m}) + m_{BC} g (1.5 - 0.5 \cos 45^\circ) \dots \\ + m_{CD} g (1.5 - 1 \cos 45^\circ - 0.25 \text{ m}) = I_A \alpha$$

$$(2 \text{ kg}) (9.81 \text{ m/s}^2) (0.75 \text{ m}) + (2 \text{ kg}) (9.81 \text{ m/s}^2) (1.5 \text{ m} - 0.5 \text{ m} \cos 45^\circ) \dots \\ + (2 \text{ kg}) (9.81 \text{ m/s}^2) (1.5 \text{ m} - 1 \text{ m} \cos 45^\circ - 0.25 \text{ m}) = 11.2758 \text{ kg m}^2 \alpha$$

$$\hookrightarrow \boxed{\alpha = 4.24 \text{ rad/s}^2}$$