

Mechanism Sessional (ME29002)



Assignment 5

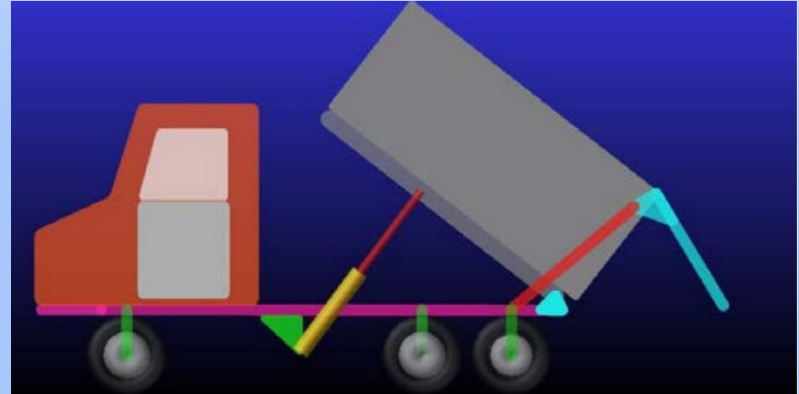
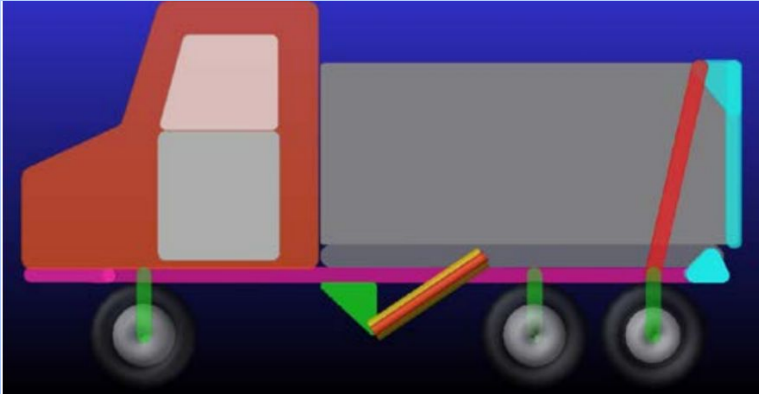
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Problem Statement

Dumper trucks typically have a gravity driven rear opening which has to be manually unlocked when it dumps. An idea to have a mechanized door that opens as the bin tilts is shown in the figures below. Synthesize and make a simulator for the mechanism taking into account the functional relation between the angle of opening and bin tilt angle. Add any new idea you might have (e.g., adjustment to change maximum door opening, automatic door locking mechanism in horizontal bin position that unlocks as the bin starts to tilt etc.)



The Aim

Adjustment to change maximum door opening of the dumper truck.

Dumper Truck Mechanism Parameters

We desire to synthesize a 4R Mechanism for dumping truck door

The bin dimensions (after scaling)

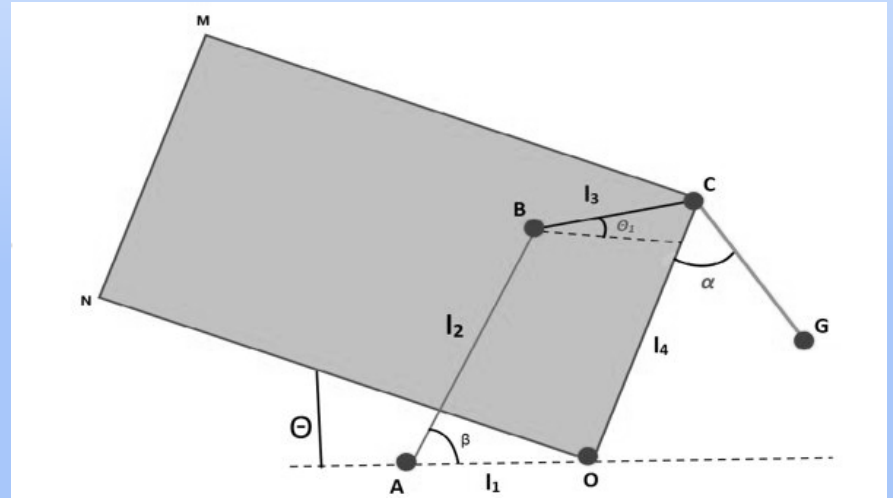
$$l_{CM} = 160 \text{ mm} \quad l_{CO} = l_4 = 75 \text{ mm}$$

The maximum door opening angle

$$\alpha_{\max} = 75^\circ$$

Distance between the hinges attached to the ground

$$l_{AO} = l_1 = 25 \text{ mm}$$



At dead Centre ($\alpha = \alpha_{\max}$) :
 At max door opened condition

In $\triangle AOC$

$$\angle ACO (\theta) = 90 - \alpha_{\max}$$

$$a = l_2 + l_3 \quad \text{----- (i)}$$

$$b = l_4$$

$$c = l_1$$

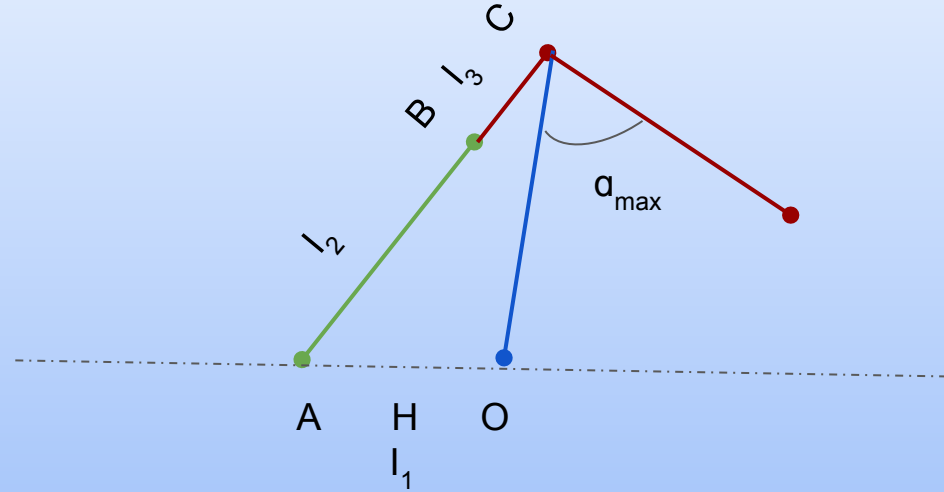
After solving the triangle, using relation

$$\cos(\theta) = a^2 + b^2 - c^2 / (2ab)$$

For α ,

$$\text{Solve } \cos(15 \times \pi / 180) = (a^2 + 75^2 - 25^2) / (2ax75)$$

$$AC = a = 88.1986 \text{ mm}$$



At Door closed condition ($\alpha = 0^\circ$)

$\triangle AHB$ is a right angled triangle

$$AH = l_1 - l_3$$

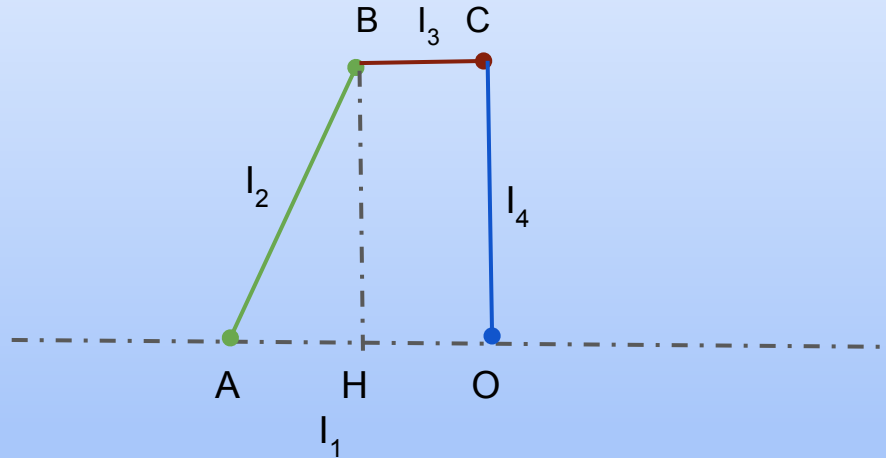
$$BH = l_4$$

$$AB = l_2$$

$$(l_2)^2 = (l_4)^2 + (l_1 - l_3)^2 \quad \text{----- (2)}$$

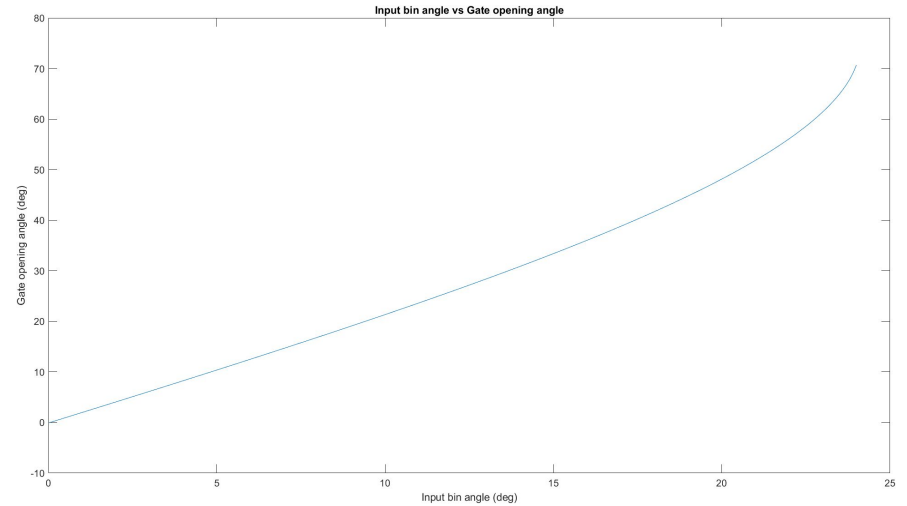
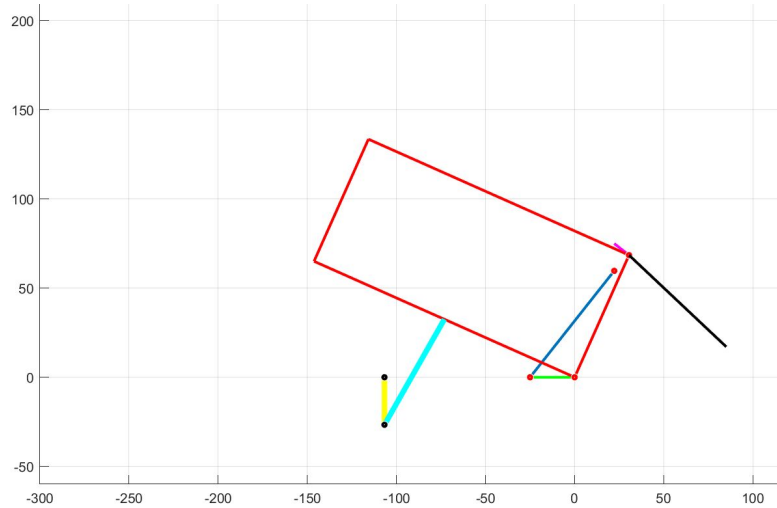
$$l_2 = 76.12 \text{ mm}$$

$$l_3 = 12.097 \text{ mm}$$



Matlab Simulation

Simulation dumper truck



The Model

