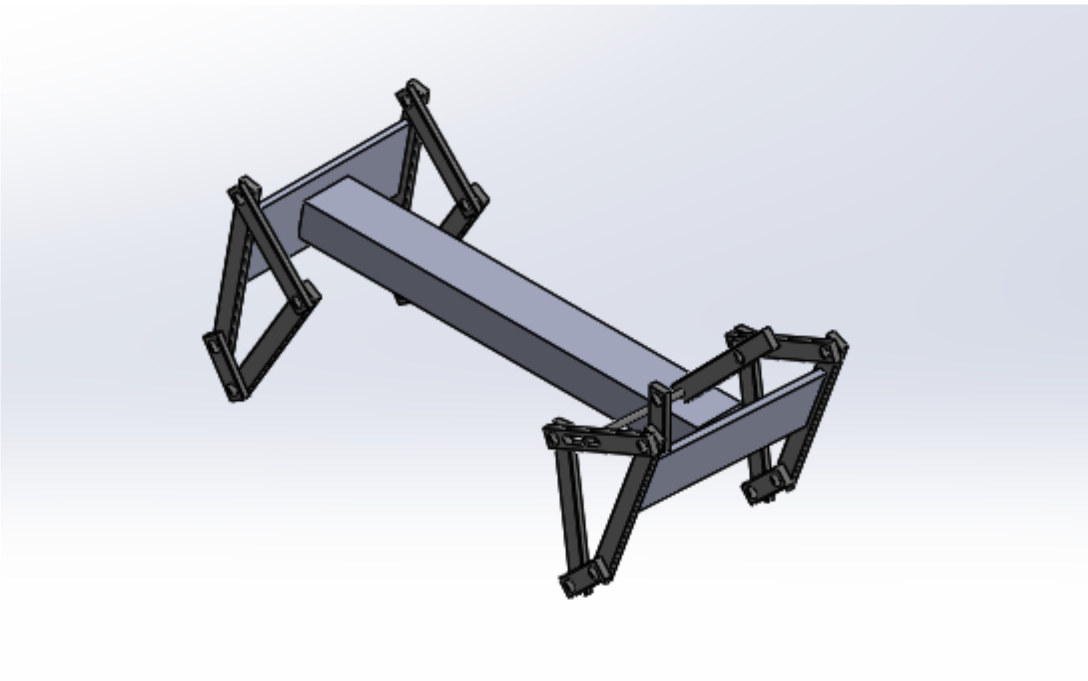
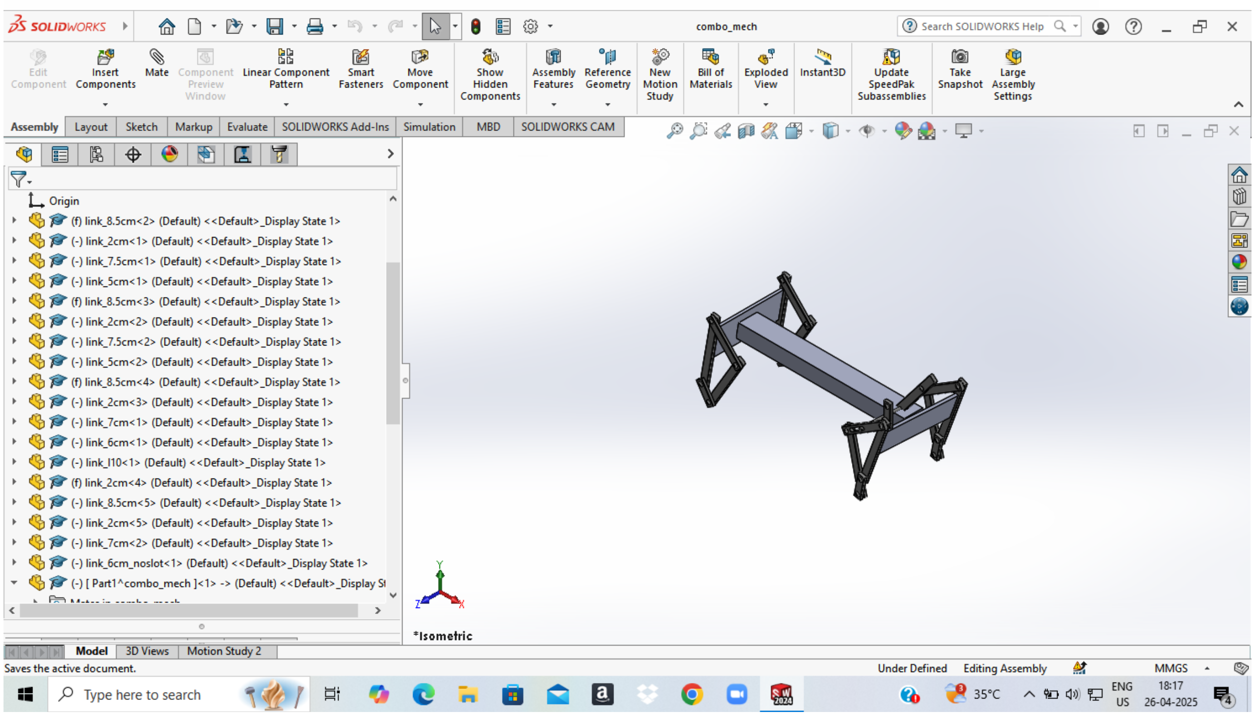
ME2220: KDM PROJECT PHASE 3
PULL ALONG DOG

NAME: MANASVI GAMPA

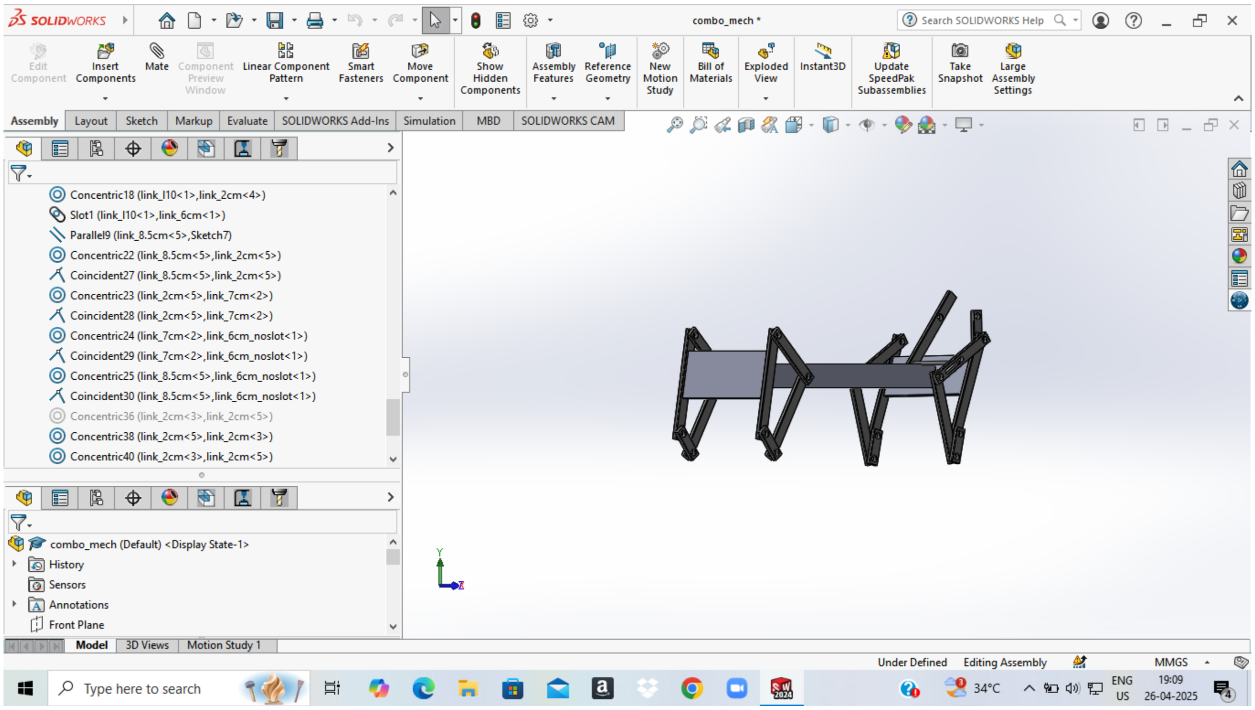
ROLL NO.: ME23BTECH11035

Isometric View of the CAD Model:

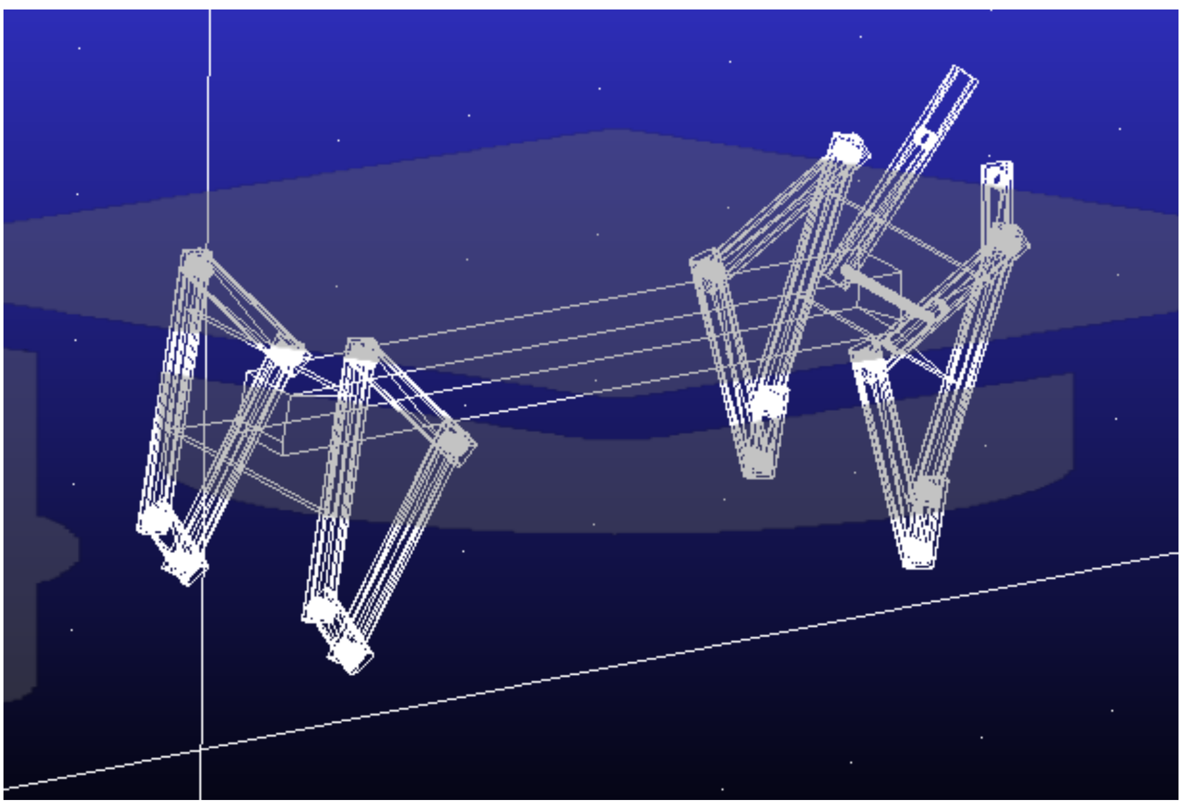


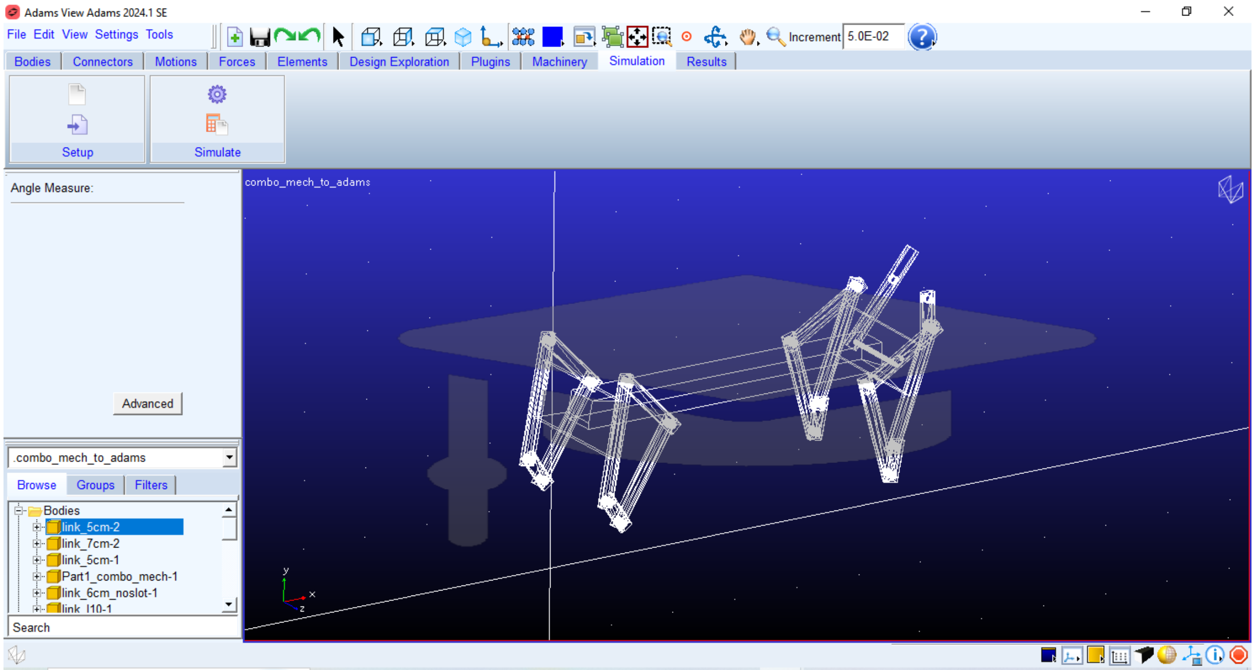


Another View:



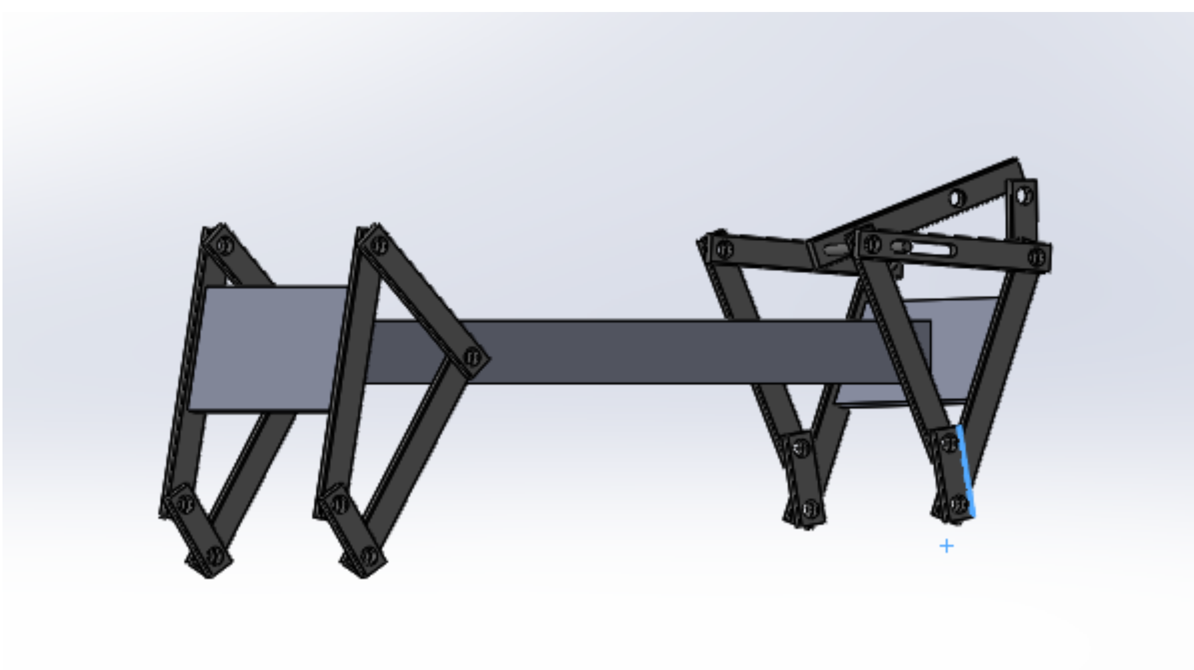
Mechanism in ADAMS:



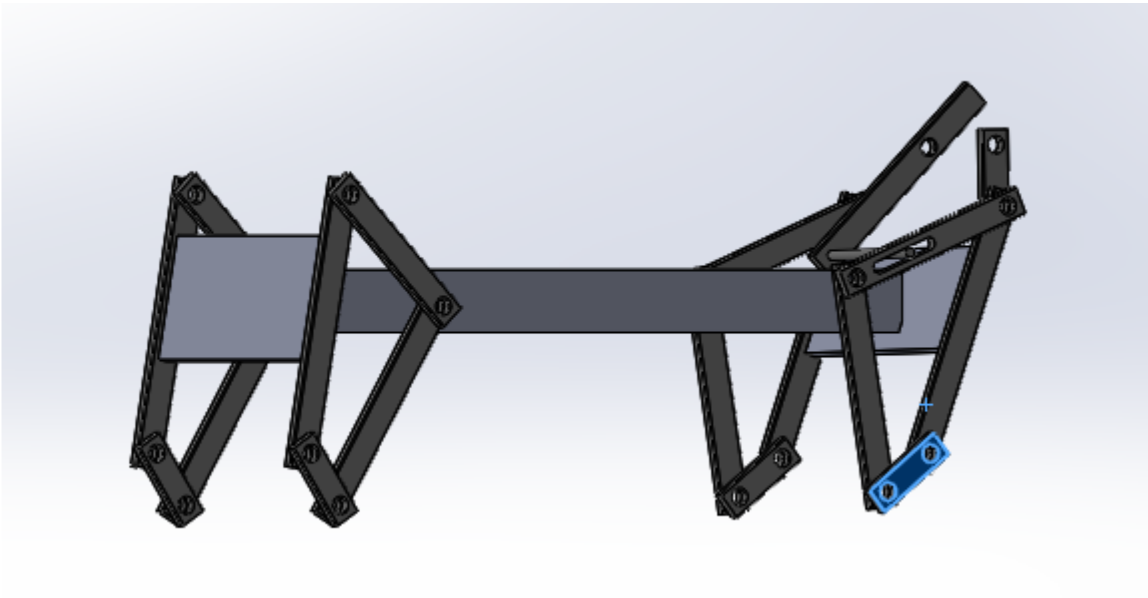


<u>Slotted Link Mechanism Working:</u>

<u>Tail Down-</u>

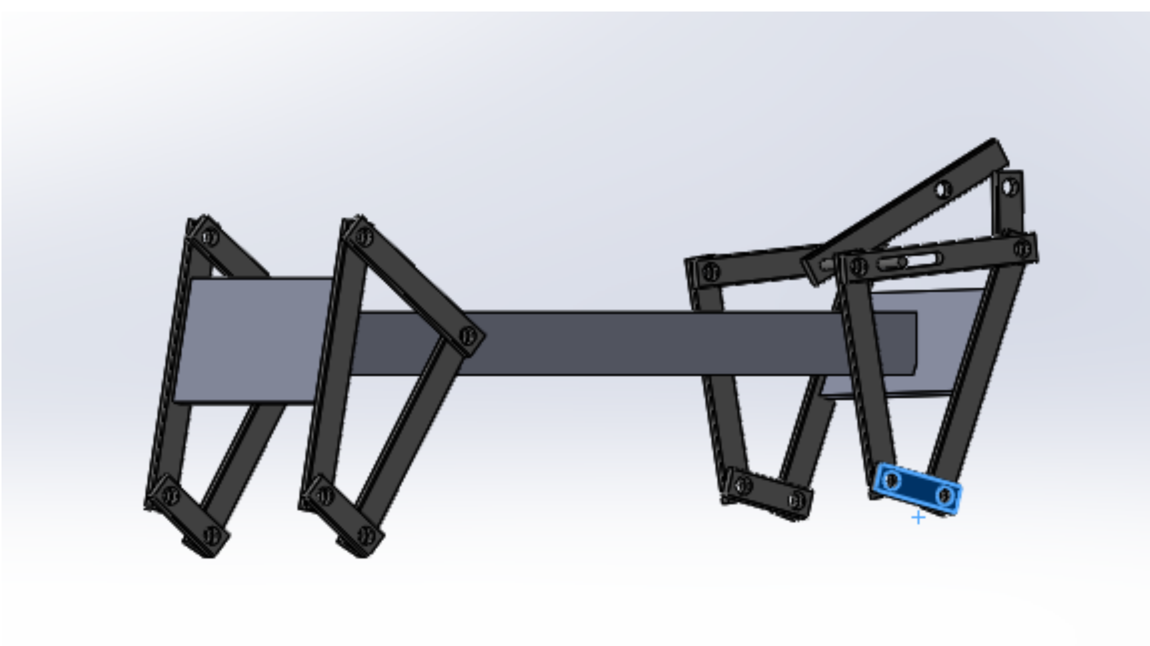


Tail Up-

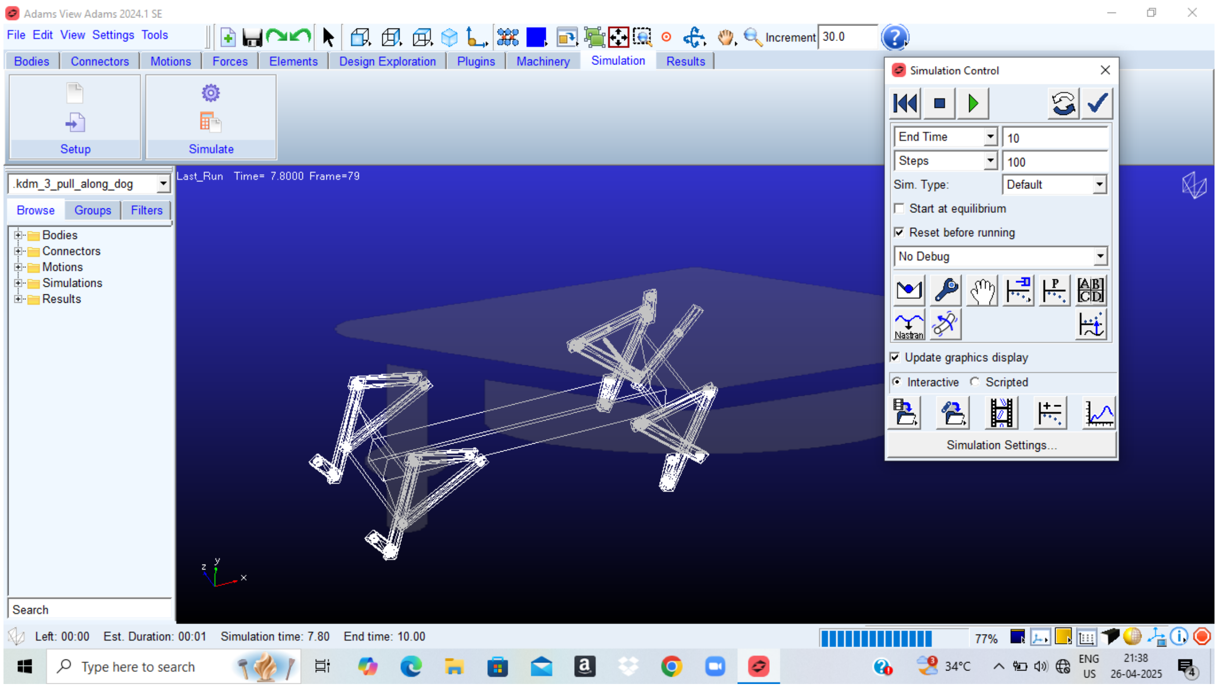


Representing how the front legs and rear legs behave separately (in toy, individually connected via shafts inside the body):

(Compare with the image above)



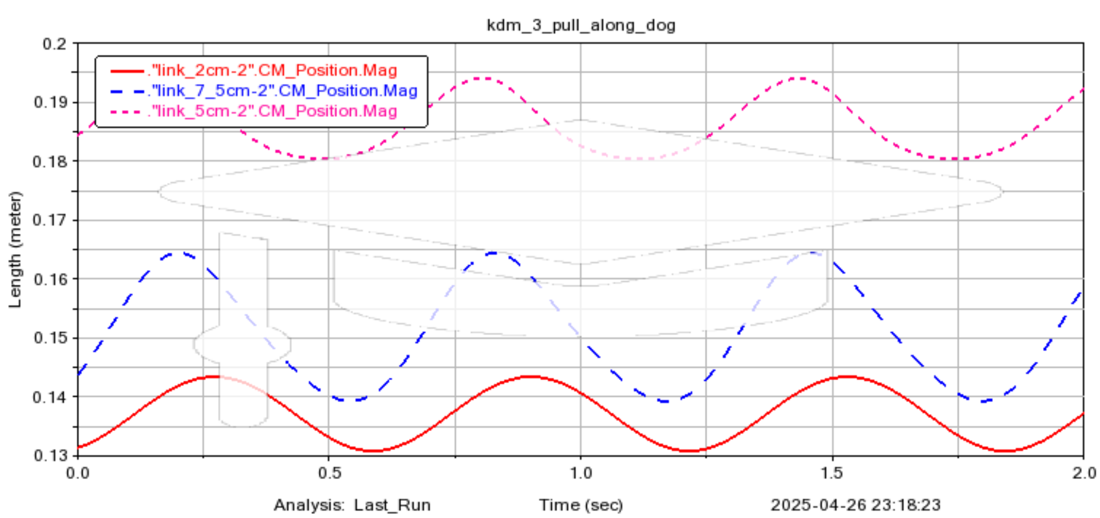
Mechanism Simulation in ADAMS:



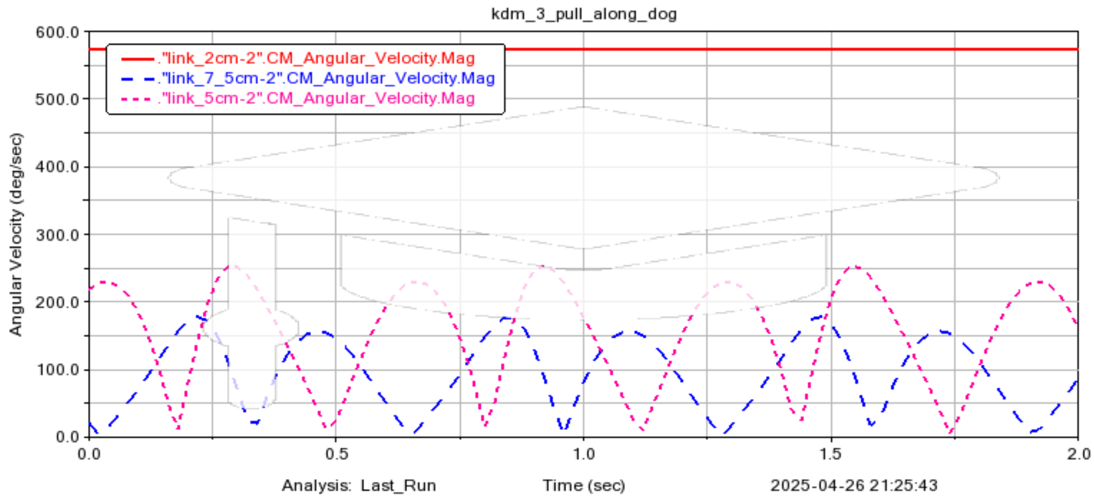
MECHANISM 1:
FRONT LEG MECHANISM:

Ideally, the body is pulled, causing the wheels (cranks, in this case) of the toy to rotate and move forward. However, in this model, I have simulated the system by applying a constant angular velocity to the crank, consistent with the approach used during the Phase 2 analysis.

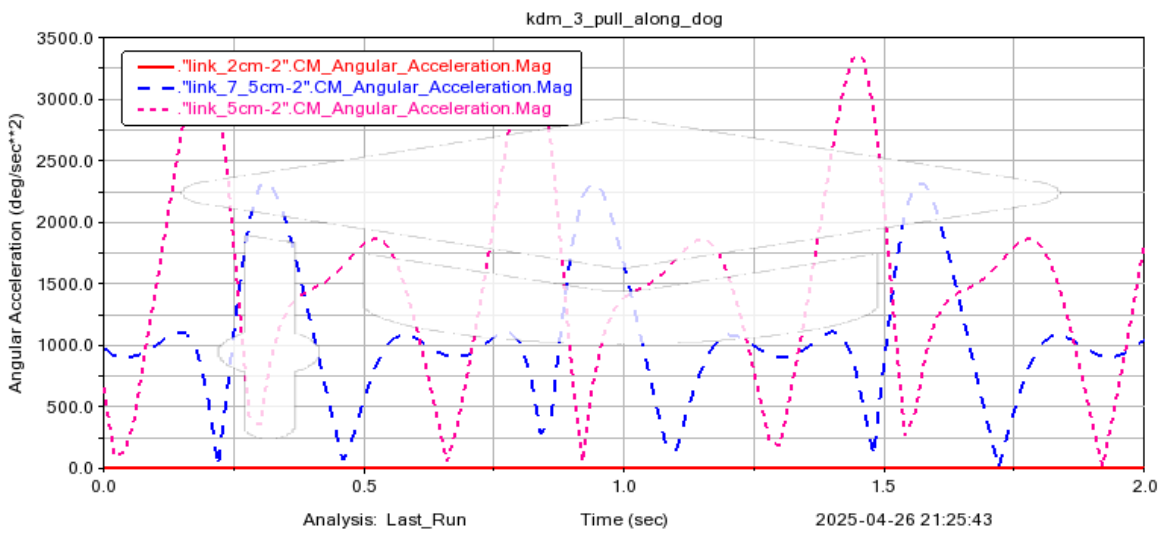
Position Vs Time:



Angular Velocity vs Time:



Angular Acceleration vs Time:



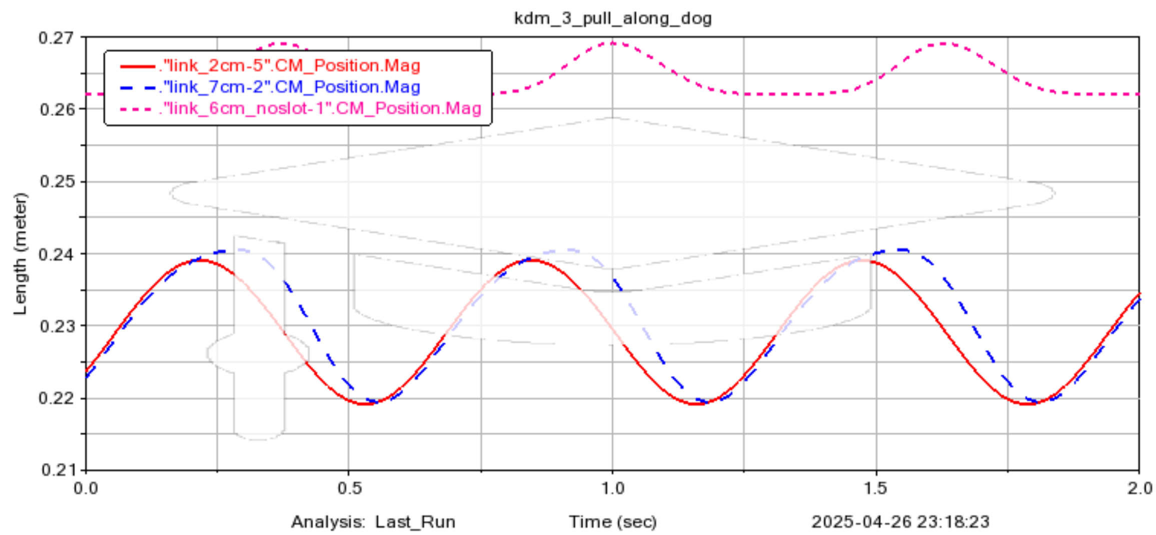
Here,
link_2_cm-2 represents the crank (foot of the dog)
link_7_5cm-2 represents the coupler (lower leg of dog)
link_5cm-2 represents the rocker (upper leg of dog)

Since both front legs are connected through a common shaft in the toy, they move together — meaning that if one leg moves, the other mirrors its motion with the same orientation and pace. As a result, their plots are identical.

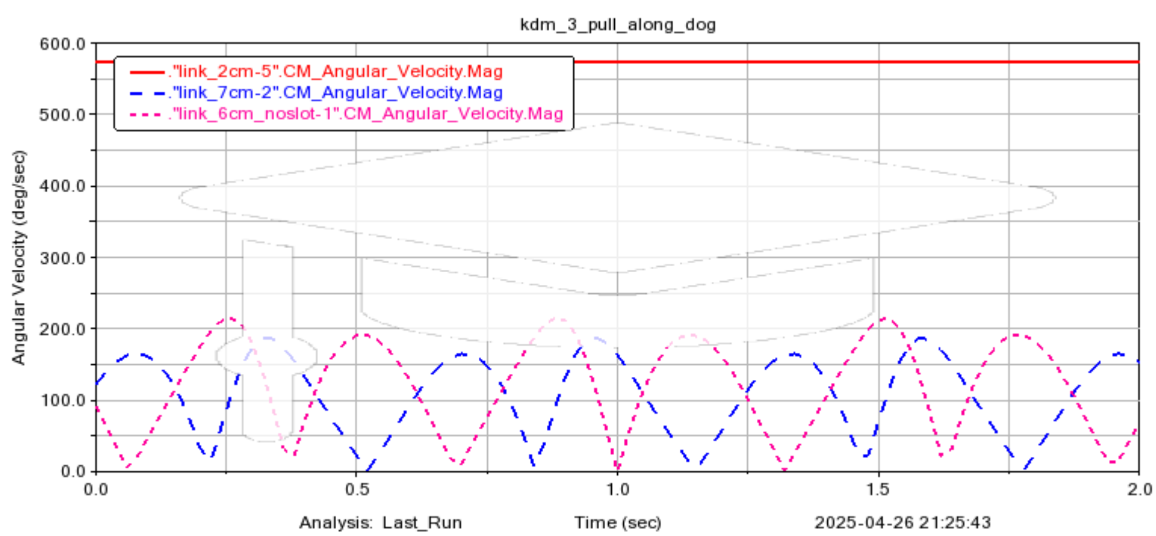
Observations and Comparisons to the plots made in Phase 2:
During Phase 2, plots were generated with respect to the input angle (i.e., the crank angle), whereas in Phase 3, plots were generated with respect to time. In both analyses, a constant angular velocity of 10 rad/s was applied to the crank. Since θ = ωt and ω is constant, it follows that θ is directly proportional to time. ***As a result, the shapes (i.e., the curves) of the plots obtained in both phases are identical.***

MECHANISM 2:
REAR LEG MECHANISM:

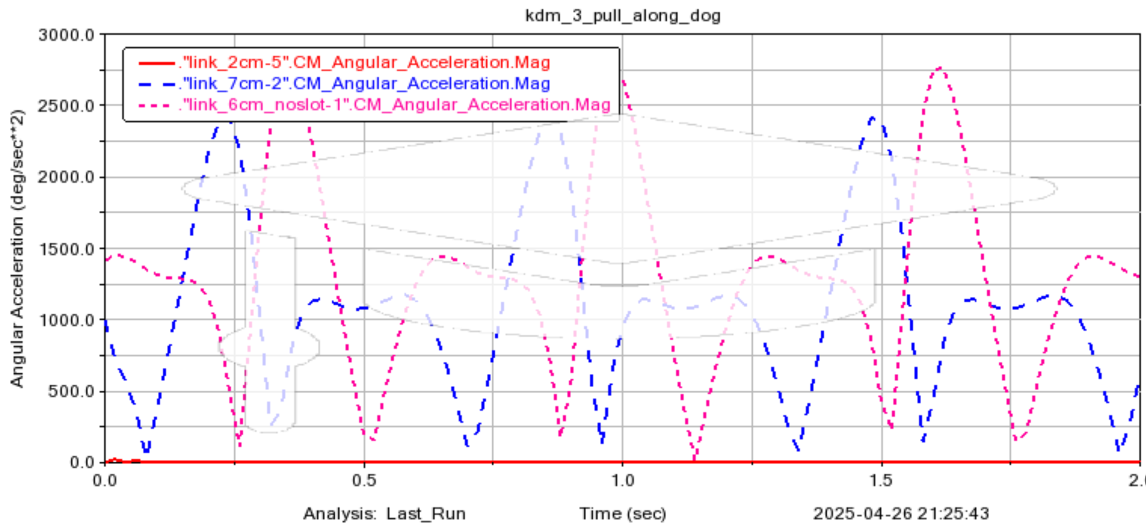
Position vs Time:



Angular Velocity vs Time:



Angular Acceleration vs Time:



Here,
link_2_cm-5 represents the crank (foot of the dog)
link_7cm-2 represents the coupler (lower leg of dog)
link_6cm_noslot-1 represents the rocker (upper leg of dog)

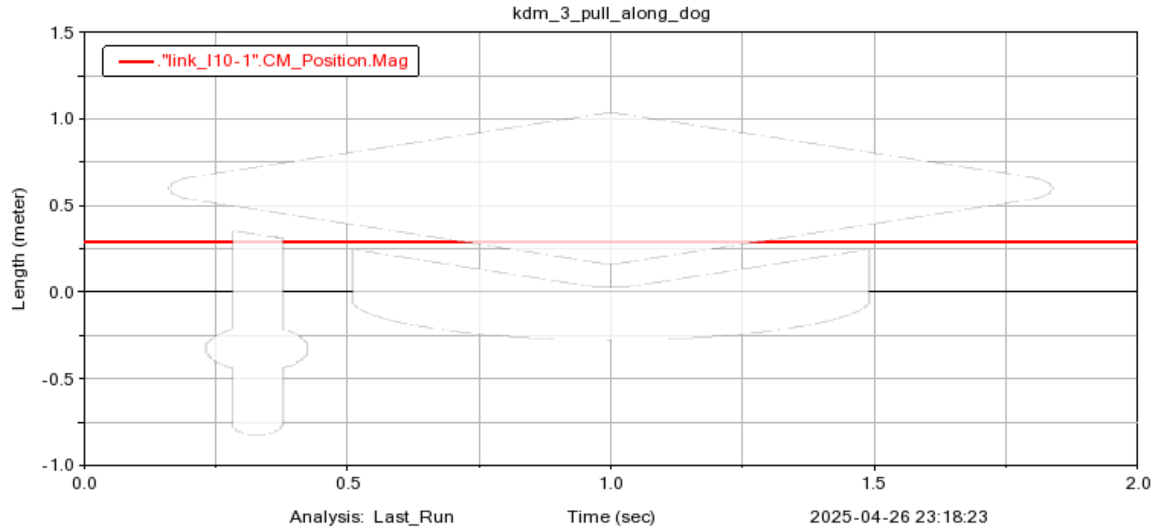
Since both rear legs are connected through a common shaft in the toy, they move together — meaning that if one leg moves, the other mirrors its motion with the same orientation and pace. As a result, their plots are identical.

Observations and Comparisons to the plots made in Phase 2:

During Phase 2, plots were generated with respect to the input angle (i.e., the crank angle), whereas in Phase 3, plots were generated with respect to time. In both analyses, a constant angular velocity of 10 rad/s was applied to the crank. Since $\theta = \omega t$ and ω is constant, it follows that θ is directly proportional to time. ***As a result, the shapes (i.e., the curves) of the plots obtained in both phases are identical.***

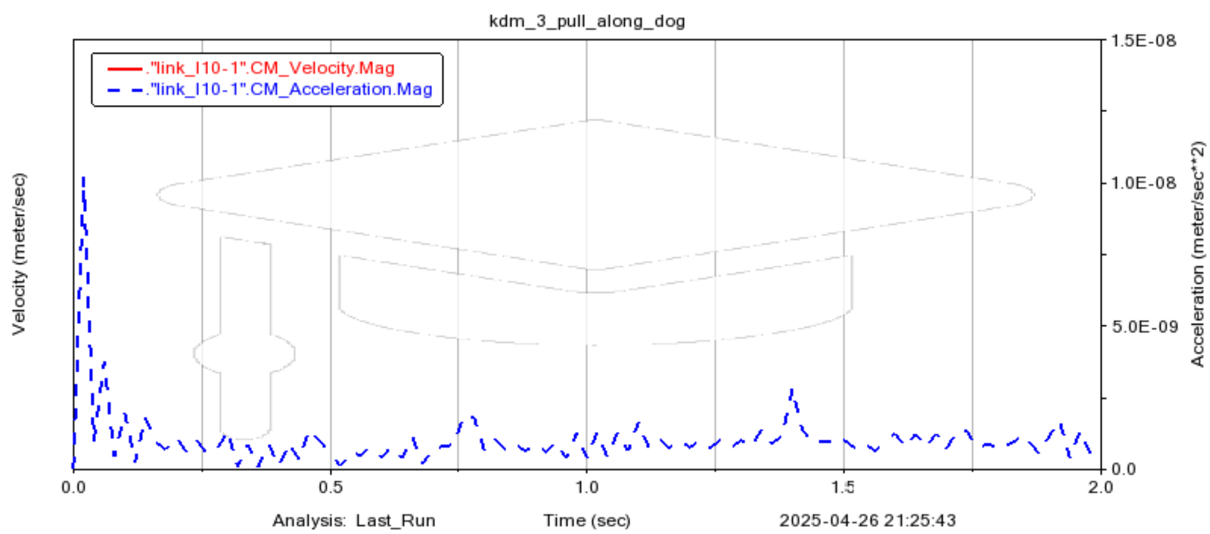
SLOTTED LINK MECHANISM:

Position vs Time:

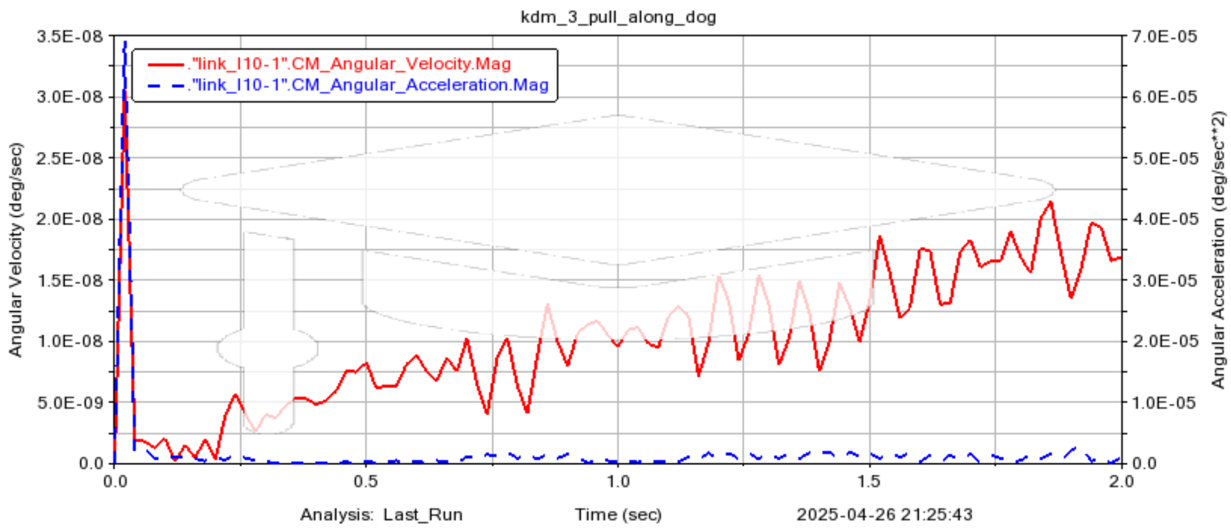


(a straight line is observed as the CM of the link stays the same, relatively.)

Velocity and Acceleration vs Time:



Angular Velocity and Angular Acceleration vs Time:



Here,
Link_l10-1 represents the output link of the slotted link mechanism (tail of the dog)

As the rocker of the rear leg mechanism moves, it causes the slotted link to oscillate up and down.

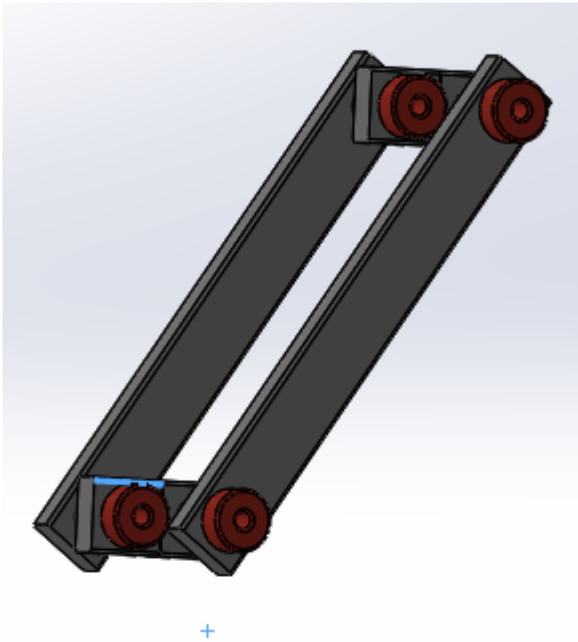
Observations and Comparisons to the plots made in Phase 2:

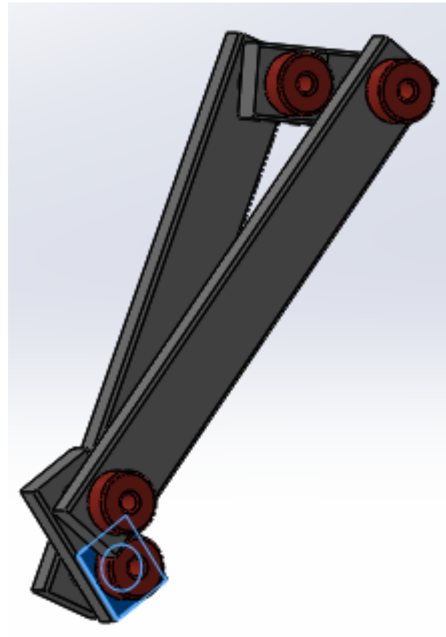
During Phase 2, plots were generated with respect to the input angle (i.e., the rocker angle), whereas in Phase 3, plots are generated with respect to time. Since the rocker oscillates clockwise and counterclockwise (driven by the crank rotation), the plots from Phase 2 and Phase 3 appear somewhat different, even though they represent the same physical behavior. Additionally, in Phase 2, the sliding motion within the slotted link is described by the position of its end within the slot, whereas in Phase 3, it is referenced relative to the center of mass. This difference further contributes to the variation observed between the two sets of plots.

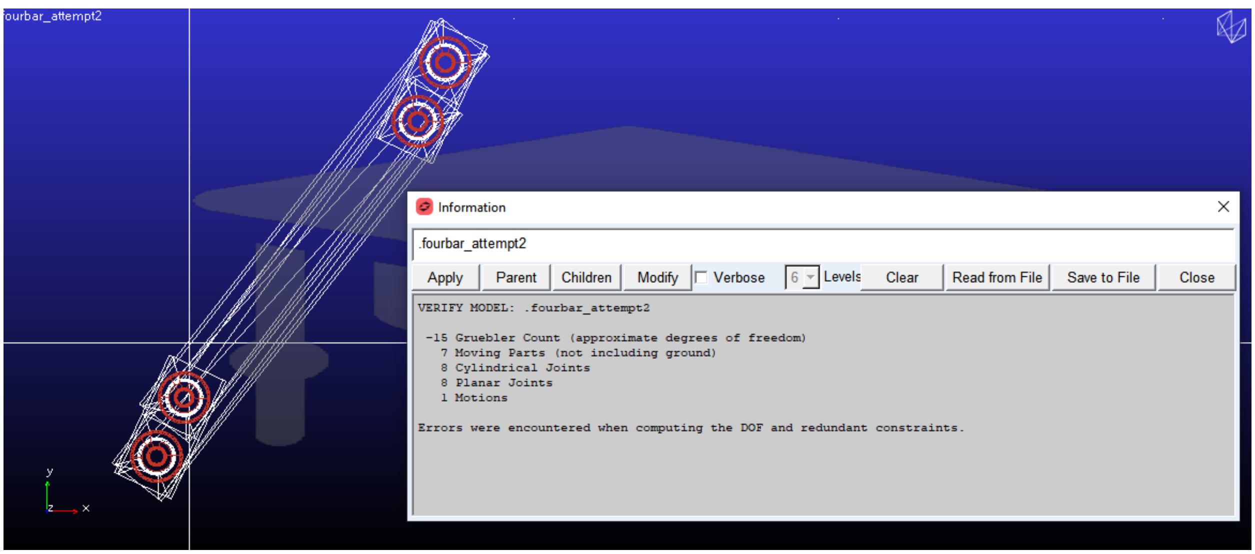
ADDITIONAL INFORMATION:

Hurdles Faced:

4 bar mechanism using the links and pins provided:







The mechanism using pins and links worked quite well in the SolidWorks Motion Analysis. However, in ADAMS, the pins appear to be treated as separate parts rather than just connectors, which made the simulation infeasible. As a result, I did not use the provided pins in my ADAMS model. Instead, I directly mated the links using concentric and coincident constraints to create revolute joints.

My Reflections and Learnings:

As a newbie to CAD modeling, the process of creating and simulating the model was incredibly insightful. It helped me bridge the gap between the analytical results from Phase 2 and the practical outcomes in Phase 3, making the overall experience truly enriching and complete.