MECHANISM SESSIONAL (ME29002)

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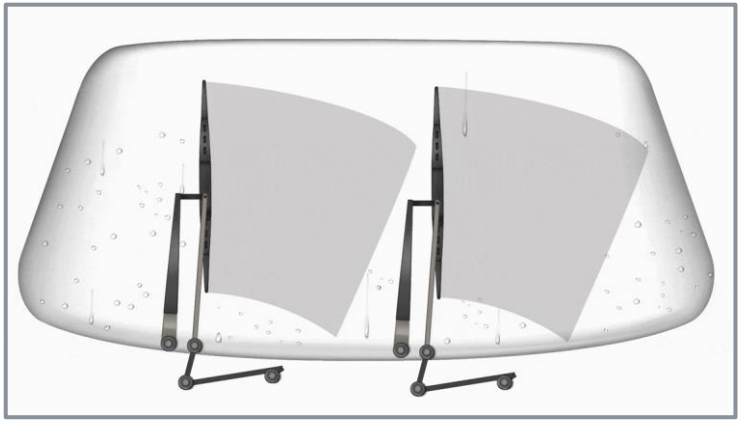
Wiper Mechanism

- Windscreen wipers are powered by an electric motor through a series of mechanical components like two 4-bar linkages.
- The electric motor is attached to a worm gear, which transmits the necessary force to a long rod that sets the wiper arms in motion.



Approach :

- In this we have analytically calculated the various angles, having 2 degree of freedoms.
- First we started with determining the relation between various angles and link lengths, using sine and cosine laws.
- Then we simulated the mechanism using MATLAB, fixed the ground links.
- Then, defined the relations in MATLAB, simulated the mechanisms, plotted the angular velocity angular acceleration curve. We have also included UI sliders to change the lengths during simulation.

Calculations of the Coordinates

- **Coordinate System**
- **Angular Velocity**
- **Angular Acceleration**

Calculations:

According to geometry, following relations can be derived:

Coordinates of A:

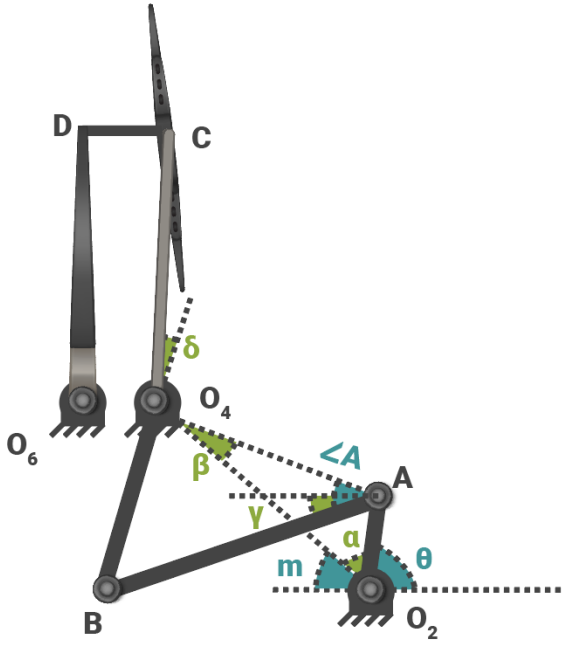
$A_x = O2_x + O2\_A*\cos(\theta);$

$A_y = O2_y + O2\_A*\sin(\theta);$

$m = \tan^{-1}(50/150)$

$\alpha = 180 - \theta - slope\_O2\_O4$

$O4\_A = \sqrt{\{(O2\_A)^2 + O2\_O4^2 - 2*O2\_A*O2\_O4*\cos(\alpha)\}}$



Calculations:

$\angle A = \cos^{-1}((o4\_a^2 + a\_b^2 - 4\_b^2)/(2*o4\_a*a\_b));$

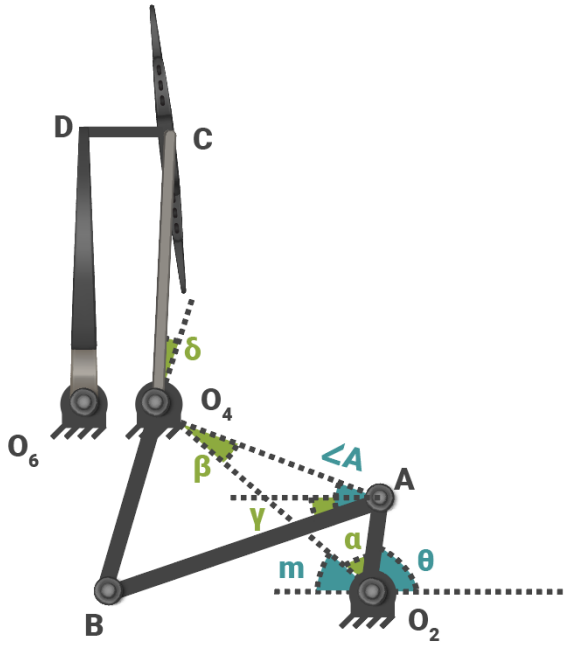
$\beta = \cos^{-1}((o4\_a^2 + o2\_o4^2 - o2\_a^2)/(2*o2\_o4*o4\_a));$

$\gamma = \angle A - (m - \beta);$

Coordinates of B:

$b_x = a_x + a\_b*\cos(\angle A);$

$b_y = a_y + a\_b*\sin(\angle A);$



Calculations:

Coordinates of C

$Cx = O4x + O4\_C * \cos(\delta)$

$Cy = O4y + O4\_C * \sin(\delta)$

Coordinates of D

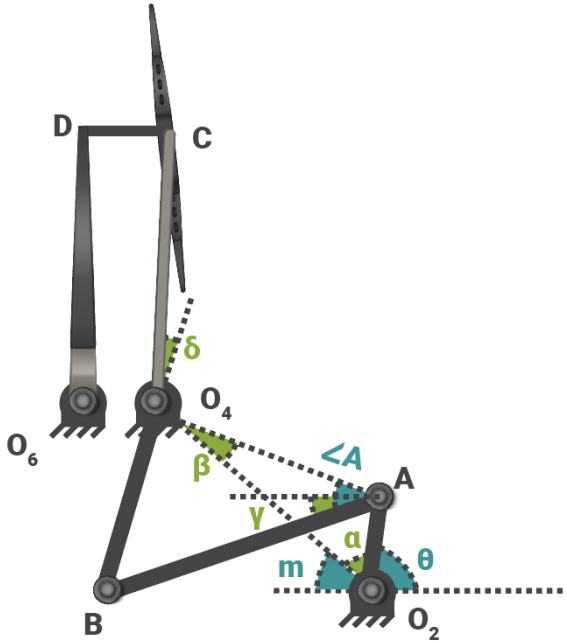
$Dx = Cx - D\_C;$

$Dy() = Cy(i);$

Coordinates of O_6

$O6x = O4x - D\_C$

$O6y = O4y$



Calculating speed & acceleration :

(Using Clock in MATLAB)

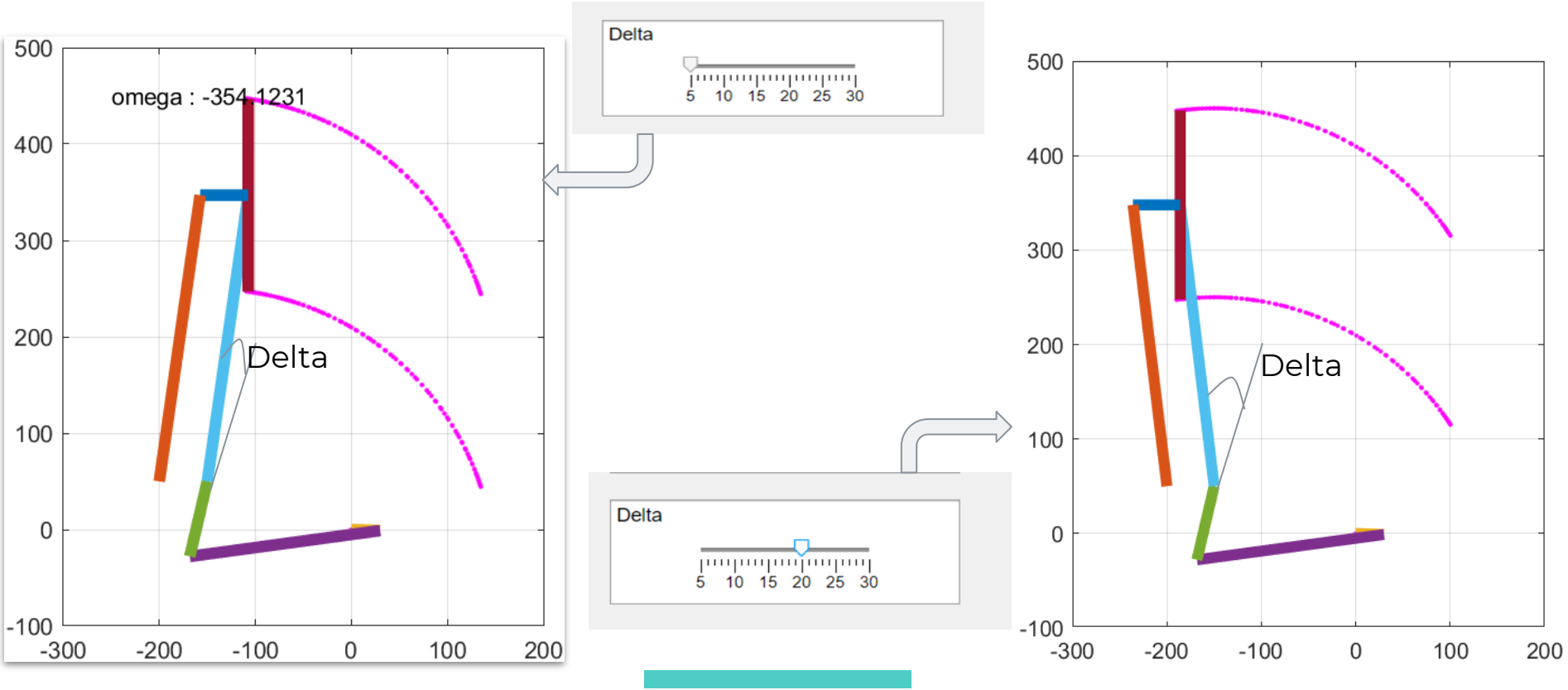
Angular Velocity

```
function x = omega(time_stmp1, time_stmp2, ang_new, ang_old)
        t1 = time_stmp1(1, 6);
        t2 = time_stmp2(1, 6);
        x = (ang_new-ang_old)/(t2-t1);
end
```

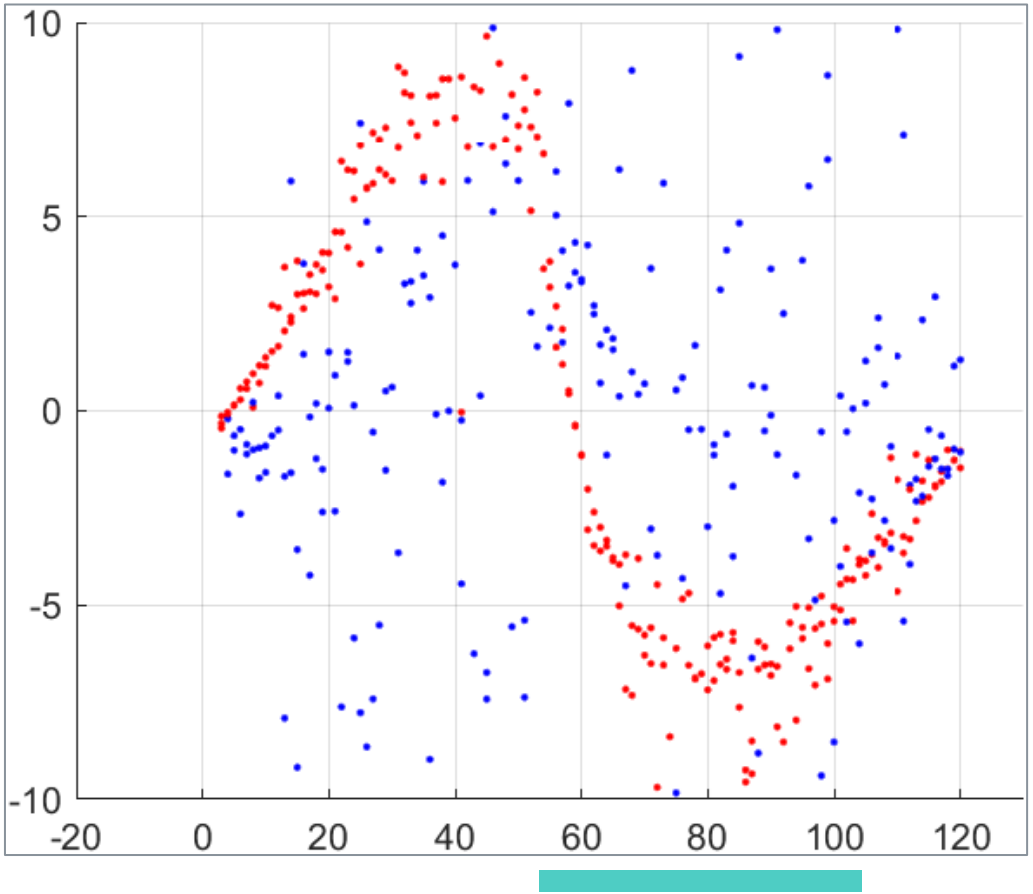
Angular Acceleration

```
function y = mu(time_stmp1, time_stmp2, ang_vel,i)
   t1 = time_stmp1(1,6);
   t2 = time_stmp2(1,6);
   y = (ang_vel(i)-ang_vel(i-1))/(t2-t1);
end
```

2. Output
(Simulation and Graphs)



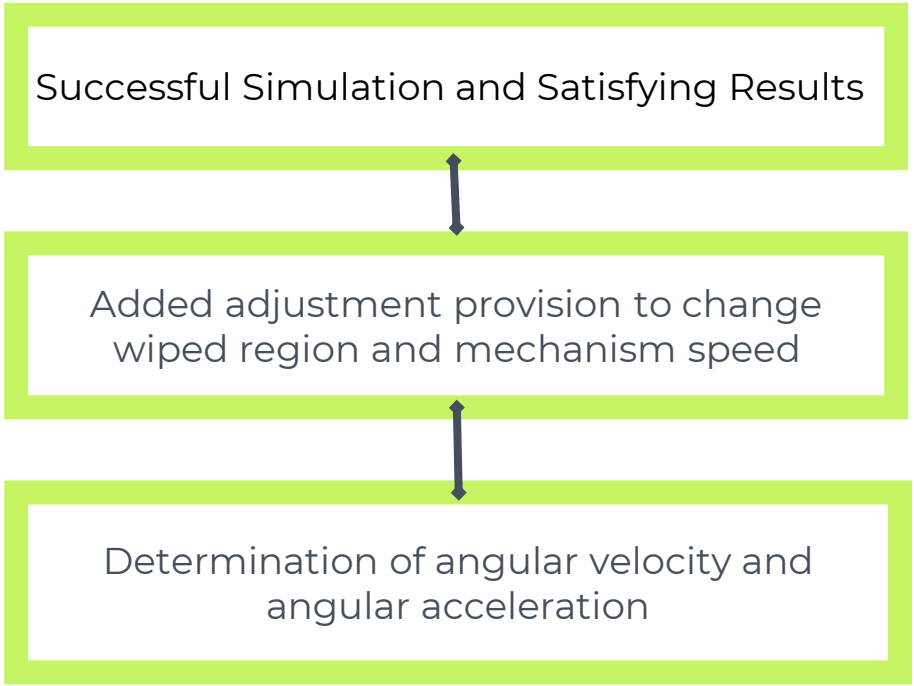
Wiping Area changes with Change in Delta



Red Dots: Angular Velocity vs θ

Blue Dots: Angular Acceleration vs θ

Conclusion


Successful Simulation and Satisfying Results
Added adjustment provision to change wiped region and mechanism speed
Determination of angular velocity and angular acceleration

Thanks!