A graph of a vehicle subject to deltaf steering angle

Description automatically generated

A graph of a vehicle

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Matlab Code for Q1.4:

1. % Use Runge-Kutta method to solve the ODE

2. clear;

3.

4. % Parameters

5. V = 1;

6. lf = 1.5;

7. lr = 1.5;

8.

9. % Time span

10. tspan = [0, 10];

11.

12. % Initial conditions

13. y0 = [0, 0, 0];

14.

15. % Run ode45

16. [t, y] = ode45(@(t, y) odefun(t, y, V, lf, lr), tspan, y0);

17.

18. % Plot figure

19. figure;

20.

21. plot(y(:,1), y(:,2));

22. title("Cooredinates of vehicle subject to deltaf steering angle")

23. xlabel("x-axis");

24. ylabel("y-axis");

25.

26. % Create function for ODE

27. % y(t) = [X(t), Y(t), psi(t)]

28.

29. function dydt = odefun(t, y, V, lf, lr)

30.

31. % Front steering angle in radians

32. % Part A: Constant

33. % deltaf = 1;

34.

35. % Part B: Sinusoid normalized with period of 2 seconds

36. % deltaf = sin(pi \* t);

37.

38. % Part C: Square wave normalized with period of 2 seconds

39. % deltaf = square(pi \* t);

40.

41. dydt = zeros(3, 1);

42. dydt(1) = V \* cos(y(3));

43. dydt(2) = V \* sin(y(3));

44. dydt(3) = (V \* tan(deltaf) ) / (lf + lr);

45. end

46.