

```

clear
clc

syms x_dot y_dot phi_dot X Y phi C delta f F l_r l_f I_z m g y x

s1 = [y ;
      y_dot ;
      phi ;
      phi_dot];
s1_dot = [y_dot ;
          -phi_dot*x_dot + (2*C) / m * cos(delta) * (delta - (y_dot + l_f*phi_dot)/
x_dot) - (y_dot - l_r*phi_dot)/x_dot ;
          phi_dot
          (2*l_f*C)/I_z * (delta - (y_dot + l_f*phi_dot)/x_dot) - (2*l_r*C)/I_z*(-
(y_dot - l_r*phi_dot)/x_dot)];

s2 = [x ;
      x_dot];
s2_dot = [x_dot ;
          phi_dot*y_dot + (1/m) * (F - f*m*g)];

u = [delta ;
     F];

A1 = simplify(jacobian(s1_dot, s1));
B1 = simplify(jacobian(s1_dot, u));

e1 = solve(s1_dot == [0;0;0;0], [s1 ; u]);

A1 = subs(A1, [s1 ; u], [e1.y ; e1.y_dot ; e1.phi ; e1.phi_dot ; e1.delta ; e1.F]);
B1 = subs(B1, [s1 ; u], [e1.y ; e1.y_dot ; e1.phi ; e1.phi_dot ; e1.delta ; e1.F]);

A2 = simplify(jacobian(s2_dot, s2));
B2 = simplify(jacobian(s2_dot, u));

e2 = solve(s2_dot == [0;0], [s2 ; u]);

A2 = subs(A2, [s2 ; u], [e2.x ; e2.x_dot ; e2.delta ; e2.F]);
B2 = subs(B2, [s2 ; u], [e2.x ; e2.x_dot ; e2.delta ; e2.F]);

disp(A1)

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A_1 =

$$\begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & -\frac{2C+m}{m\dot{x}} & 0 & -\frac{m\dot{x}^2+2Cl_f-l_rm}{m\dot{x}} \\ 0 & 0 & 0 & 1 \\ 0 & -\frac{2C(l_f-l_r)}{I_z\dot{x}} & 0 & -\frac{2C(l_f^2+l_r^2)}{I_z\dot{x}} \end{pmatrix}$$

disp(B1)

B1 =

$$\begin{pmatrix} 0 & 0 \\ \frac{2C}{m} & 0 \\ 0 & 0 \\ \frac{2Cl_f}{I_z} & 0 \end{pmatrix}$$

disp(A2)

A2 =

$$\begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$$

disp(B2)

B2 =

$$\begin{pmatrix} 0 & 0 \\ 0 & \frac{1}{m} \end{pmatrix}$$

