6-DOF EOM Simulink Models for Cessna 172

Model Parameters

- Inertia matrix: $\mathbf{I} = \begin{bmatrix} 948 & 0 & 0 \\ 0 & 1346 & 0 \\ 0 & 0 & 1467 \end{bmatrix}$ kg · m^2
- Mass: 1088.62 kg
- Simulation time: 30 s
- Initial position: $\mathbf{p} = [0,\ 0,\ -1000]$ m
- Initial velocity: $\mathbf{v} = [100,\ 0,\ 0]$ m/s

Constant Forces and Moments Inputs to EOM

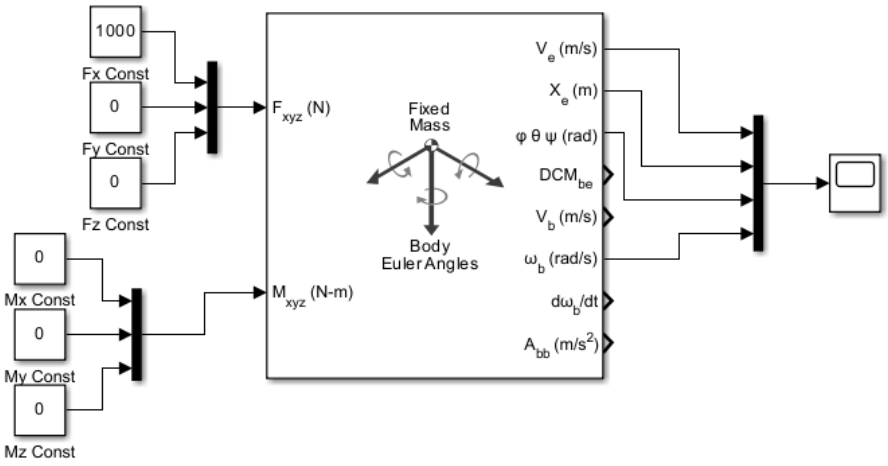

Figure 1: Simulink Model for Test Cases 1-4

Table 1: Summary of Constant Force and Moment Inputs and Aircraft Output Effects

Test Case	Input Forces (N)	Input Moments (Nm)	Expected Output Effects
1	$F = [1000; 0; 0]$	$M = [0; 0; 0]$	Velocity/Position plots
2	$F = [1000; 0; 0]$	$M = [0; 1000; 0]$	Pitch angle, Pitch rate
3	$F = [0; 1000; 0]$	$M = [0; 0; 0]$	Side force causing lateral motion
4	$F = [1000; 0; 0]$	$M = [0; 0; 500]$	Forward acceleration + steady yaw moment

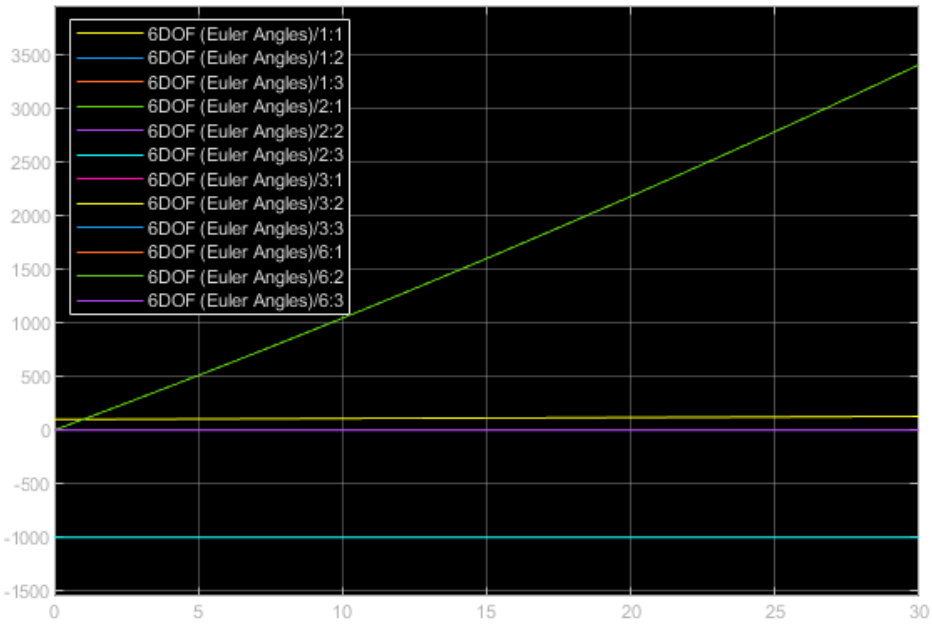

Figure 2: Plot for Test Case 1

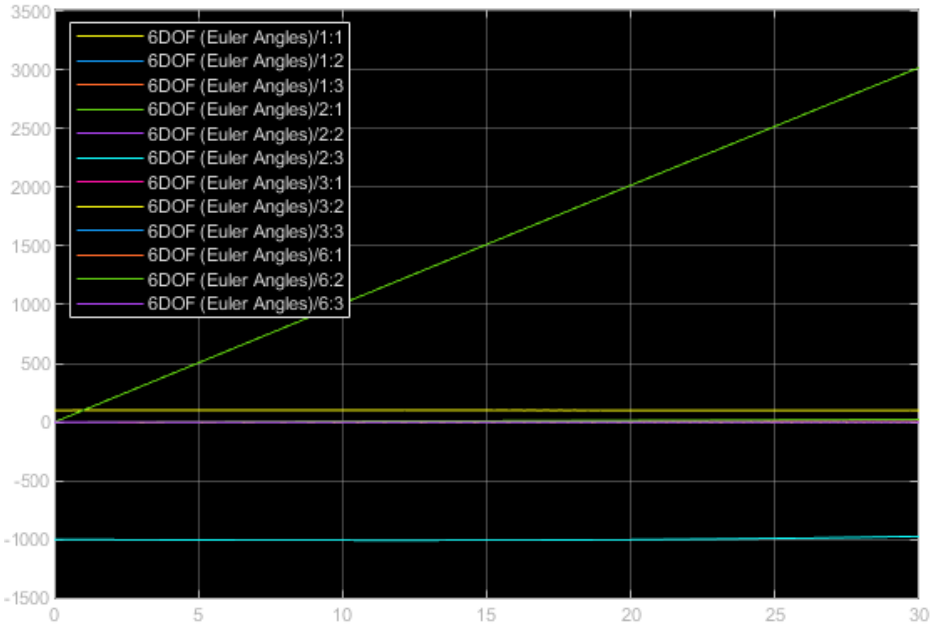

Figure 3: Plot for Test Case 2

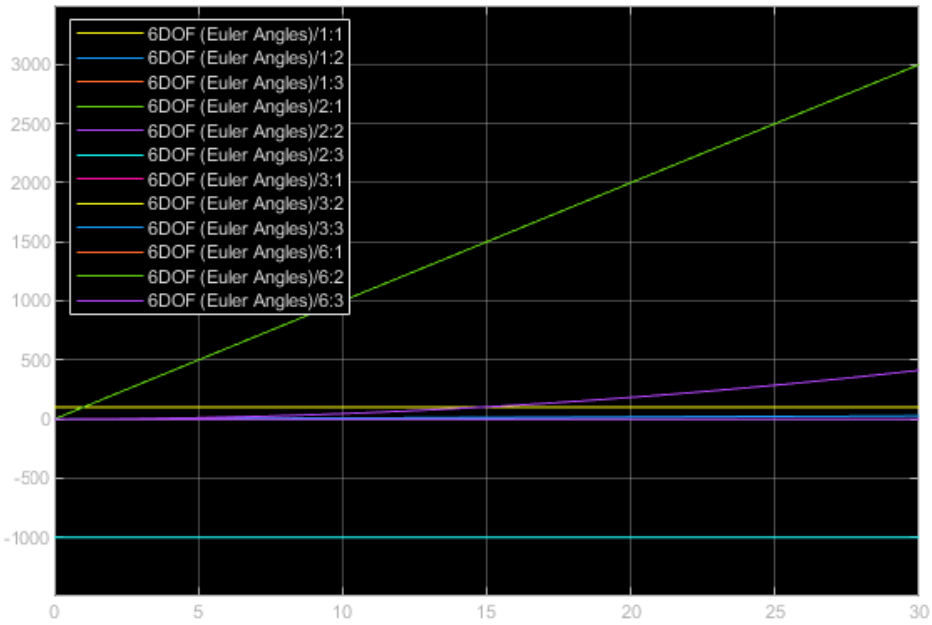

Figure 4: Plot for Test Case 3

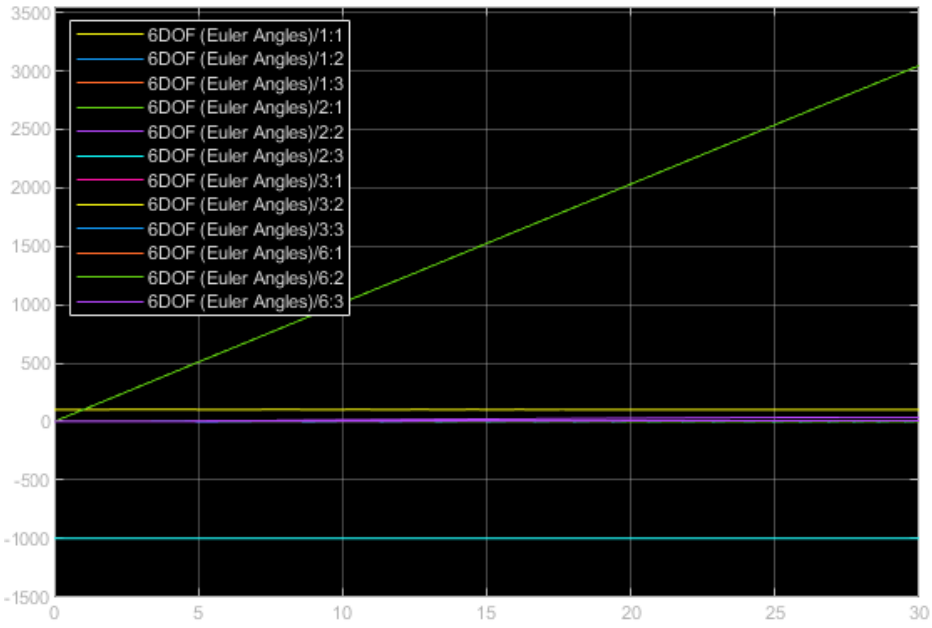

Figure 5: Plot for Test Case 4

Constant Forces and Saturation Moments Inputs to EOM

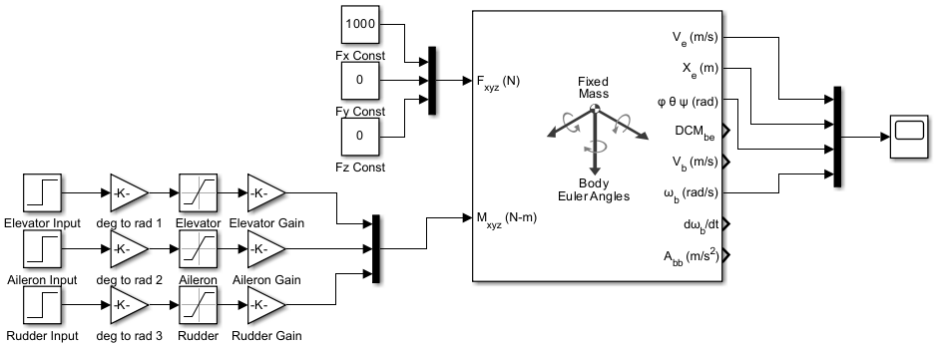

Figure 6: Simulink Model for Test Case 5

Table 2: Test Case 5: Control Inputs, Saturation, and Resulting Moments

Surface	**Input (deg)**	**Saturation (deg)**	**Saturated (rad)**	**Gain (Nm/rad)**
Elevator	30	± 25	0.4363	500
Aileron	15	± 20	0.1745	300
Rudder	35	± 30	0.5236	400

$$\textbf{Force Input Vector: } \mathbf{F} = \begin{bmatrix} 1000 \\ 0 \\ 0 \end{bmatrix} \text{ N}$$

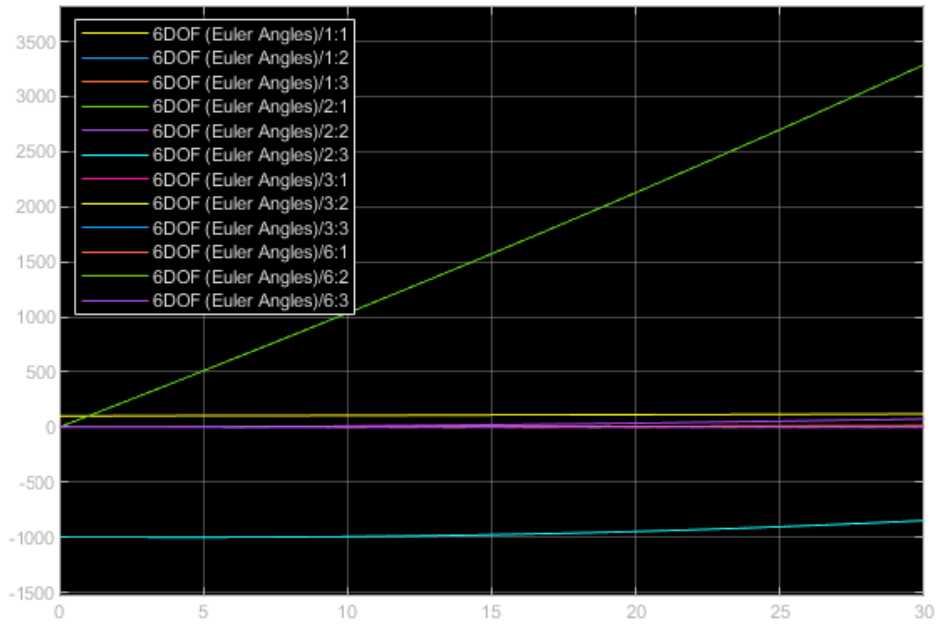

Figure 7: Plot for Test Case 5