

# AircraftPitch\_ControlDigital2

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```
In [1]: import sympy
        from IPython.display import Latex, display
        from sympy import Poly
        from sympy.abc import s, z

        import control
        from control.matlab import *
```

```
In [2]: %pylab %matplotlib inline
```

UsageError: unrecognized arguments: inline

## 1 Aircraft Pitch: Digital Controller Design

In this page, we will consider the digital version of the aircraft pitch control problem. A sampled-data version of the airplane pitch dynamics can be obtained from the continuous model, as we will describe. In this example we will apply state-space techniques to design the controller. From the [Aircraft Pitch: System Modeling](#) page, the continuous-time state-space model of the aircraft pitch dynamics was derived as

$$\begin{bmatrix} \dot{\alpha} \\ \dot{q} \\ \dot{\theta} \end{bmatrix} = \begin{bmatrix} -0.313 & 56.7 & 0 \\ -0.0139 & -0.426 & 0 \\ 0 & 56.7 & 0 \end{bmatrix} \begin{bmatrix} \alpha \\ q \\ \theta \end{bmatrix} + \begin{bmatrix} 0.232 \\ 0.0203 \\ 0 \end{bmatrix} [\delta]$$
$$y = \begin{bmatrix} 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \alpha \\ q \\ \theta \end{bmatrix} + [0][\delta]$$

where the input is elevator deflection angle  $\delta$  and the output is the aircraft pitch angle  $\theta$ . For a step reference of 0.2 radians, the design criteria are the following.

- Overshoot less than 10
- Rise time less than 2 seconds
- Settling time less than 10 seconds
- Steady-state error less than 2