AircraftPitch_ControlStateSpace

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

        from control.matlab import *

In [2]: %pylab %matplotlib inline

UsageError: unrecognized arguments: inline
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1 Aircraft Pitch: State-Space Methods for Controller Design

In the Aircraft Pitch: System Modeling page. the state-space model of the plant 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 δ and the output is the aircraft pitch angle θ. The above equations match the general, linear state-space form.

$$\frac{d\mathbf{x}}{dt} = A\mathbf{x} + Bu$$

$$y = C\mathbf{x} + Du$$

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 In this page we will apply a state-space controller design technique. In particular, we will attempt to place the closed-loop poles of the system by designing a controller that calculates its control based on the state of the system.