

Homework 2

Question 1

Calculate the aircraft trim states for straight and level flight. Then integrate your force and moment model and your 6DOF EOM model of Homework 1 and verify that your calculated trim condition does in fact balance the forces and moments (and thus makes the aircraft fly straight and level) in the simulation.

Question 2

Obtain the linear longitudinal and lateral models of the aircraft described in Appendix A of your notes. Analyse the natural longitudinal and lateral modes of motion. What is the damping and natural frequency of the aircraft's various open loop poles? Explain what physical mode of motion each pole or pole set describes.

For each longitudinal and lateral mode, initialise your simulation with the eigenvector that correspond to the eigenvalue of that particular mode. (If the eigenvectors are complex conjugates, add them together and divide by two, to obtain a real vector to initialise the simulation with.) The eigenvector should be used as a perturbation relative to the trim state vector, i.e. add the eigenvector to the trim state. Make sure to scale the eigenvector perturbation down so that the perturbation is small enough to remain in the linear region of your nonlinear flight simulation.

Verify that the damping and natural frequency of the simulated response for each longitudinal and lateral mode corresponds to the values calculated from the aircraft's open loop poles.