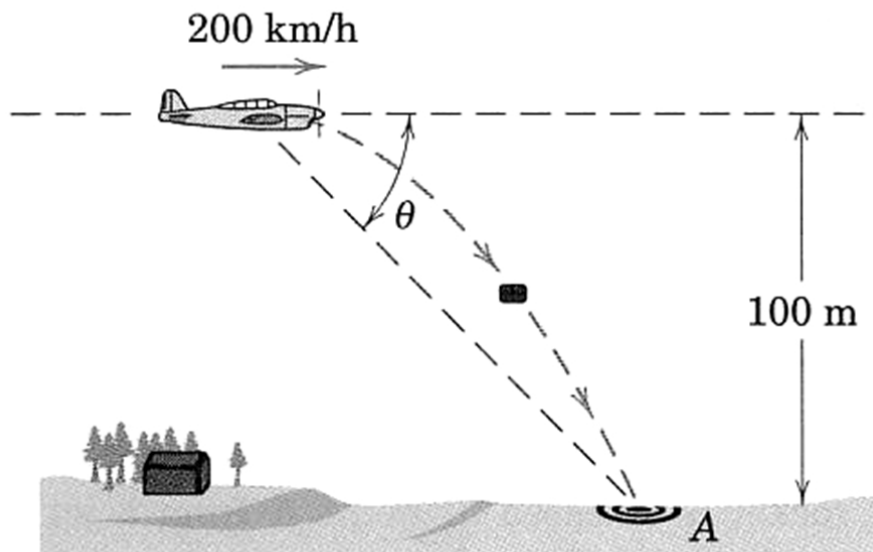


2.003/1.053 Dynamics and Controls I Problem Set 1

Issued on Monday, February 12th
Due on Tuesday, February 20st
(at the beginning of lecture)

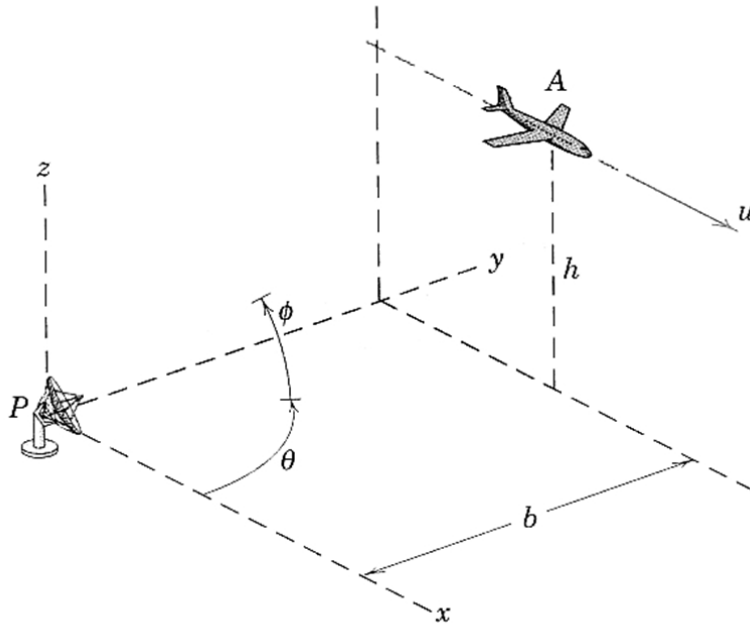
1 Payload release

The pilot of an airplane carrying a package of mail to a remote outpost wishes to release the package at the right moment to hit the recovery location A . What angle θ with the horizontal should the pilot's line of sight to the target make at the instant of release? The airplane is flying horizontally at an altitude of 100 m with a velocity of 200 km/h.



2 Radar antenna

The radar antenna P tracks the jet aircraft A , which is flying horizontally at speed u and altitude h above the level of P . Determine the expressions for the components of the velocity in the spherical coordinates of the antenna motion.



3 Satellite orbit

An earth satellite is put into a circular polar orbit at an altitude of 240 km, which requires an orbital velocity of 27 940 km/h. with respect to the center of the earth considered fixed in space. In going from south to north, when the satellite passes over an observer on the equator, in which direction does the satellite appear to be moving? The equatorial radius of the earth is 6378 km, and the angular velocity of the earth is 0.729×10^{-4} rad/s.

4 Rotating arm

Rotation of the arm PO is controlled by the horizontal motion of the vertical slotted link. If $\dot{x} = 4$ ft/s and $\ddot{x} = 30$ ft/s when $x = 2$ in., determine $\dot{\theta}$ and $\ddot{\theta}$ for this instant.

