AOE 3134 Stability and Control
Topics

I Static Stability and Control
- A. Definition of Static Stability and Application
- B. Longitudinal Static Stability
  - 1. Estimating Aerodynamic Properties
    - a) Lifting surface properties
      - i) lift curve slope
      - ii) mean aerodynamic chord
      - iii) mean aerodynamic chord location
      - iv) aerodynamic center location
      - v) pitch moment coefficient
    - b) Aircraft properties
      - i) lift curve slope
      - ii) pitch moment curve slope (longitudinal stability parameter)
      - iii) aerodynamic center (neutral point)
      - iv) static margin
      - v) tail downwash change with angle of attack
  - 2. Sensitivity of aerodynamic properties with respect to changes in geometric properties
  - 3. Use of charts and equations in Appendices B and C
  - 4. Longitudinal stability derivatives - definition, understanding and significance
- C. Lateral-Directional Static Stability
  - 1. Estimating Aerodynamic Properties
    - a) Lifting surface properties (as above)
    - b) Fuselage properties (where appropriate)
    - c) Wing contributions to yaw and roll derivatives
    - d) Aircraft properties
      - i) weathercock stability parameter
      - ii) dihedral effect stability parameter
      - iii) vertical tail sidewash change with sideslip angle
  - 2. Sensitivity of aerodynamic properties with respect to change in geometric properties
  - 3. Use of charts and equations in Appendices B and C
  - 4. Lateral- directional stability derivatives - definition, meaning and significance

II. Control Deflections and Stick Forces
- A. Longitudinal Considerations
  - 1. Elevator angle for balance
  - 2. Angle of attack for balanced flight
  - 3. Hinge moments
    - a). Stick-free static margin
    - b). Stick-fixed and stick free maneuver point
  - 4. Free elevator factor
  - 5. Elevator angle/per g (pull-up and horizontal turn)
  - 6. Stick-force per/g

7. Forward and aft limits of cg for various purposes

B. Lateral Directional Considerations
1. Aileron and Rudder Deflections
a) Engine out
b) Cross-wind landings
c) Turning flight

III. Aircraft Dynamics
A. Longitudinal Dynamics
1. Pinned aircraft (y axis) characteristics
a) Time to half amplitude, and time constant
b) Frequency and period
c) Damping ratio
2. Full fourth order system
a) Modes of motion and their characteristics
b) Methods of extracting information for higher order systems

B Lateral-Directional Dynamics
1. Roll approximation (first order system)
a) Roll mode time constant
b) Time to half amplitude
c) Response to aileron step input
d) Roll angle calculation
2. Pinned approximation in yaw
a) Characteristics of motion
i) time to half
ii) frequency and period
iii) damping ratio

C. General
1. Sketch (accurate) response in time
2. Characteristic values and their meaning
3. Determine effects of geometric changes on dynamic characteristics