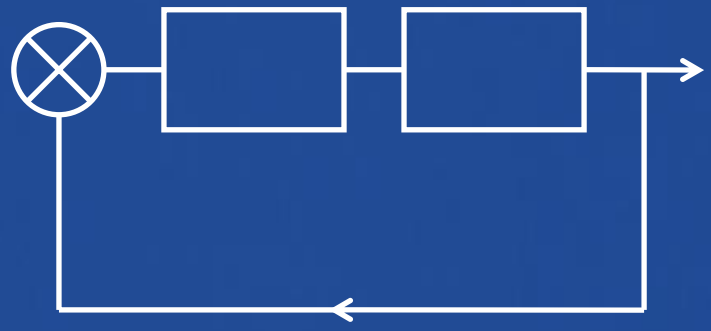
DEVELOPMENT OF AUTOMATIC FLIGHT CONTROL SYSTEM



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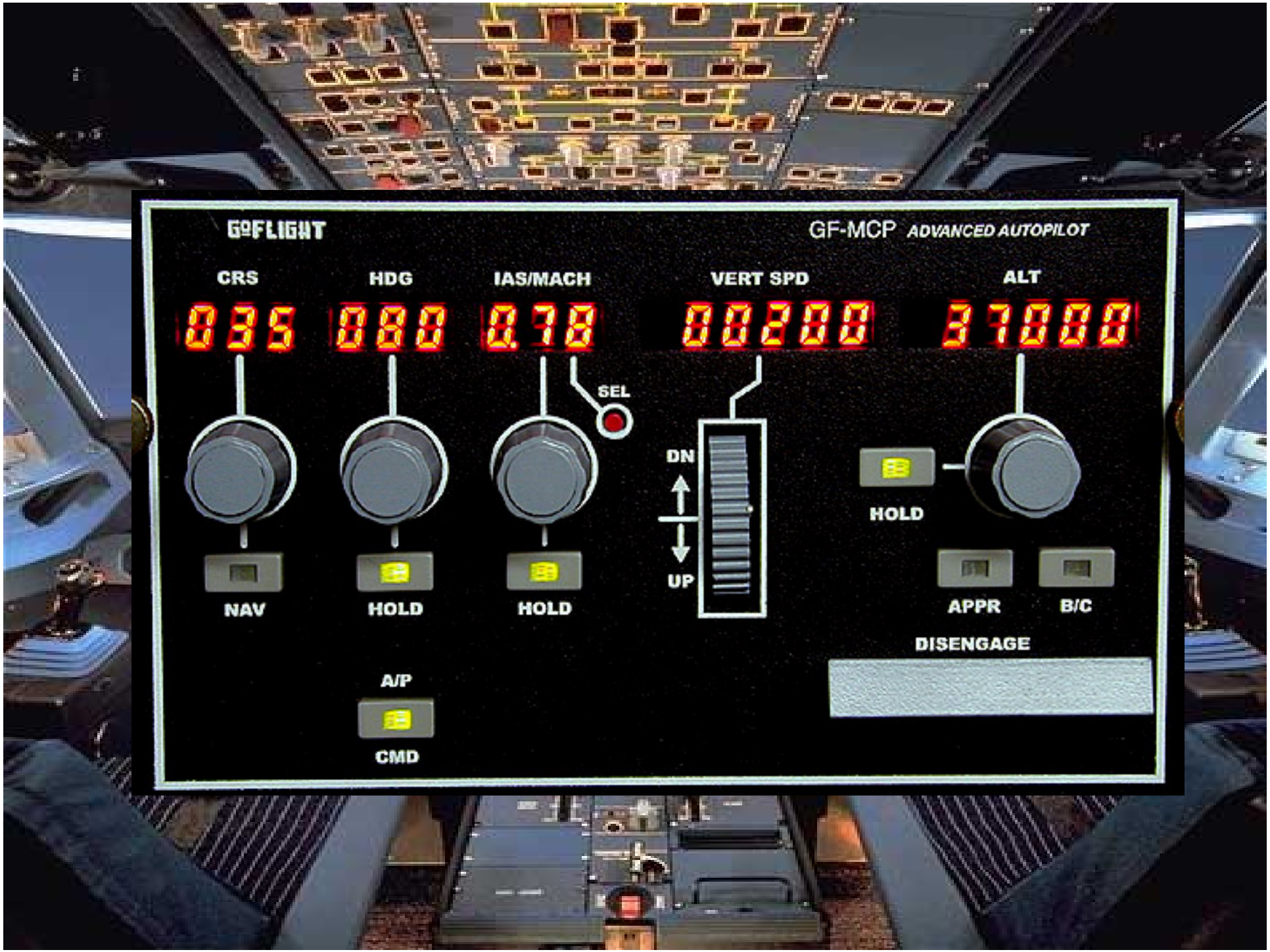
Course: Avionics
Supervisor: Dr. Zoubir

Aim:

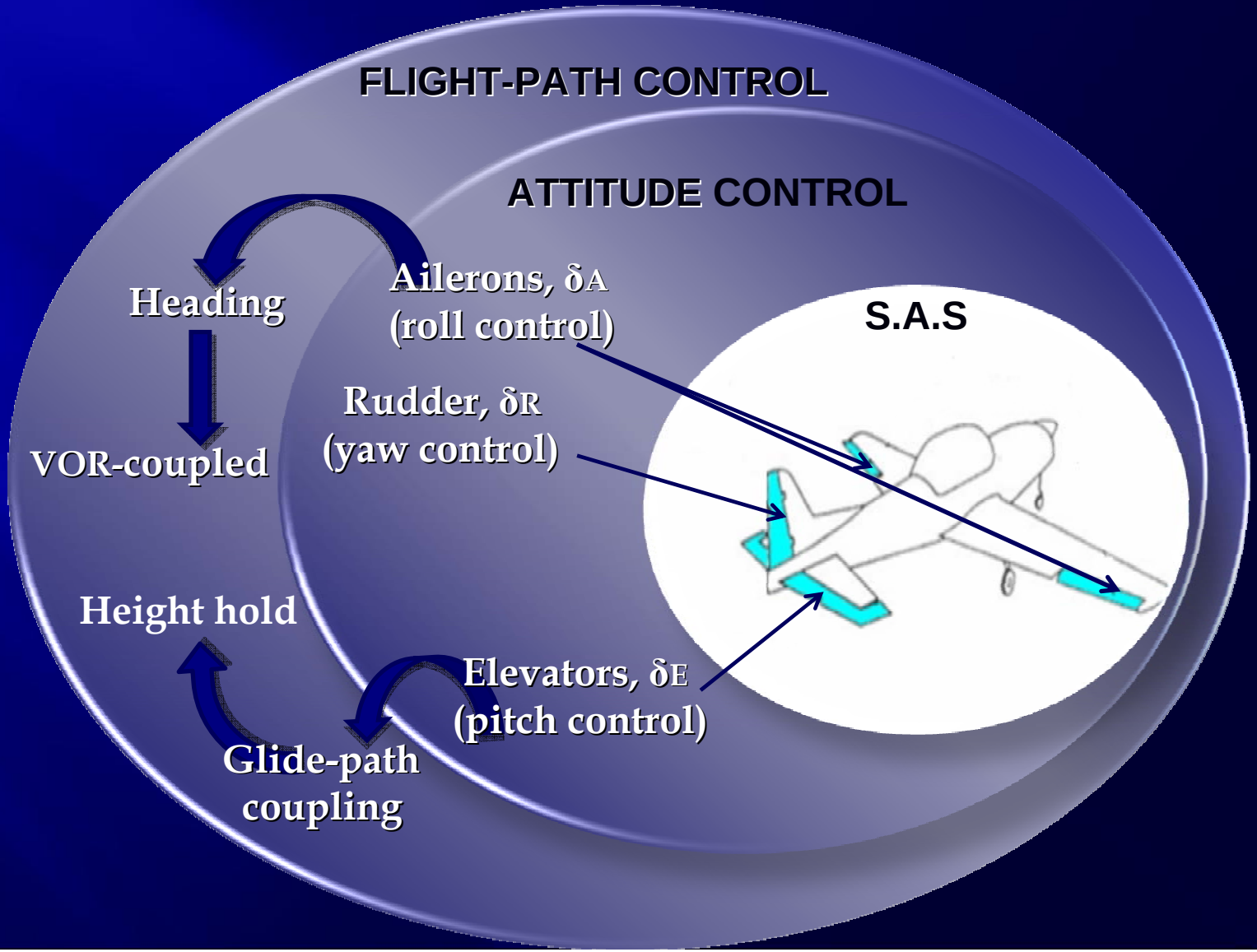
To develop an autopilot or an AFCS. The Design has been conducted in the Matlab environment .

Objectives:

- Know concepts about control system designs.
- Develop flight dynamic models for an aircraft perturbation motion.
- Design state space and transfer function models(longitudinal and lateral).
- Research flying quality analysis.
- Develop and enhance handling and flying qualities.
- Understand and choose which control system design approach is better.
- Be familiar with advance programming techniques using Matlab.

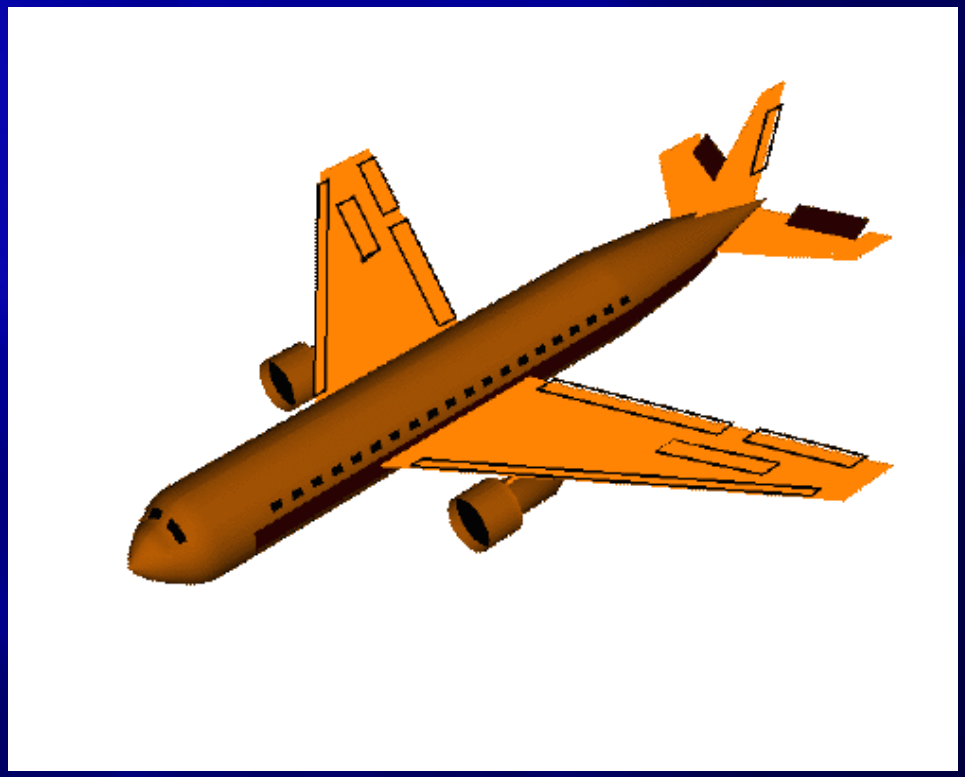

GoFLIGHT
GF-MCP ADVANCED AUTOPILOT
CRS
HDG
IAS/MACH
VERT SPD
ALT
085
080
078
00200
37000
SEL
DN
UP
NAV
HOLD
HOLD
HOLD
APPR
B/C
A/P
CMD
DISENGAGE

DESIGN PROCESS



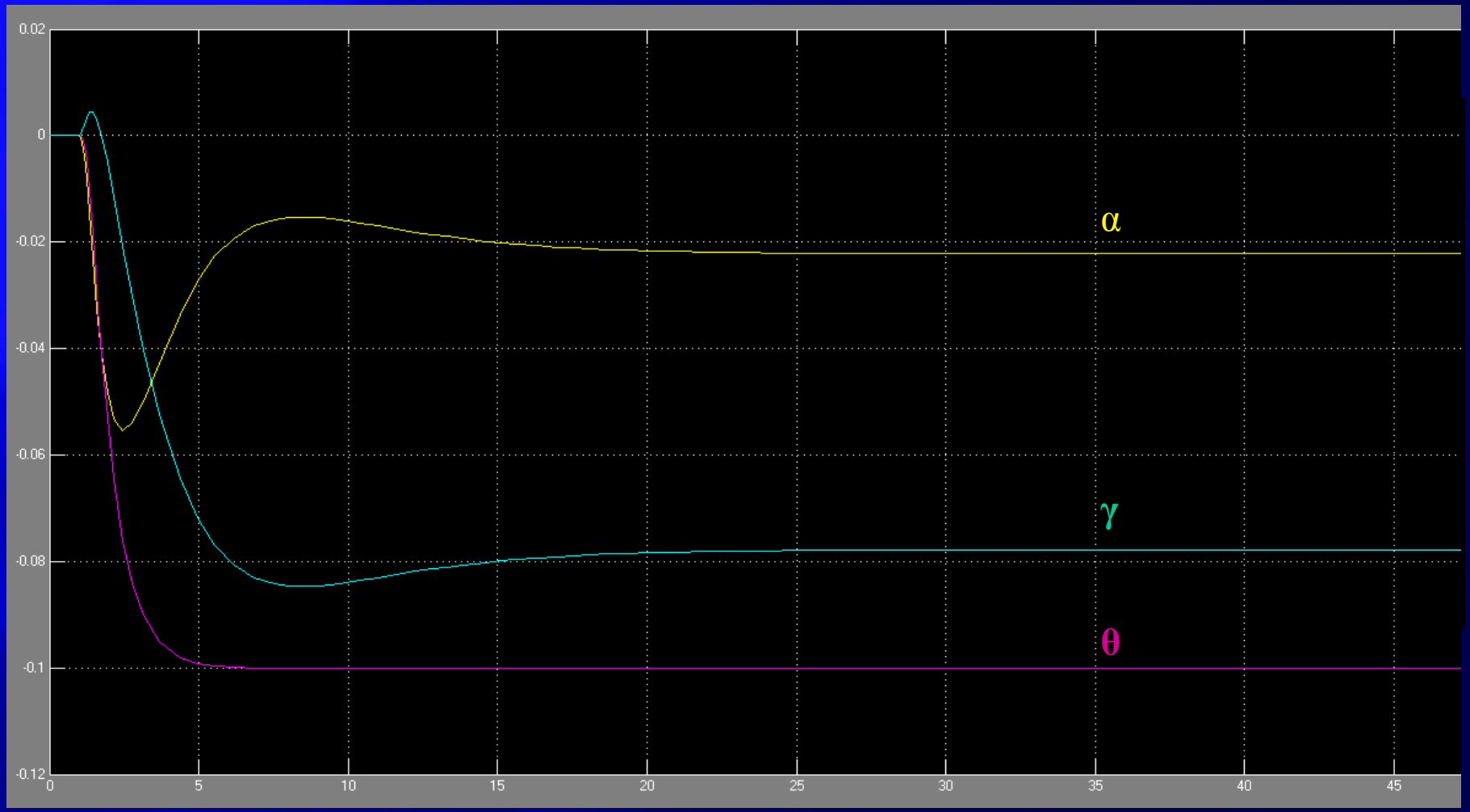
PITCH ATTITUDE

PITCH CONTROL

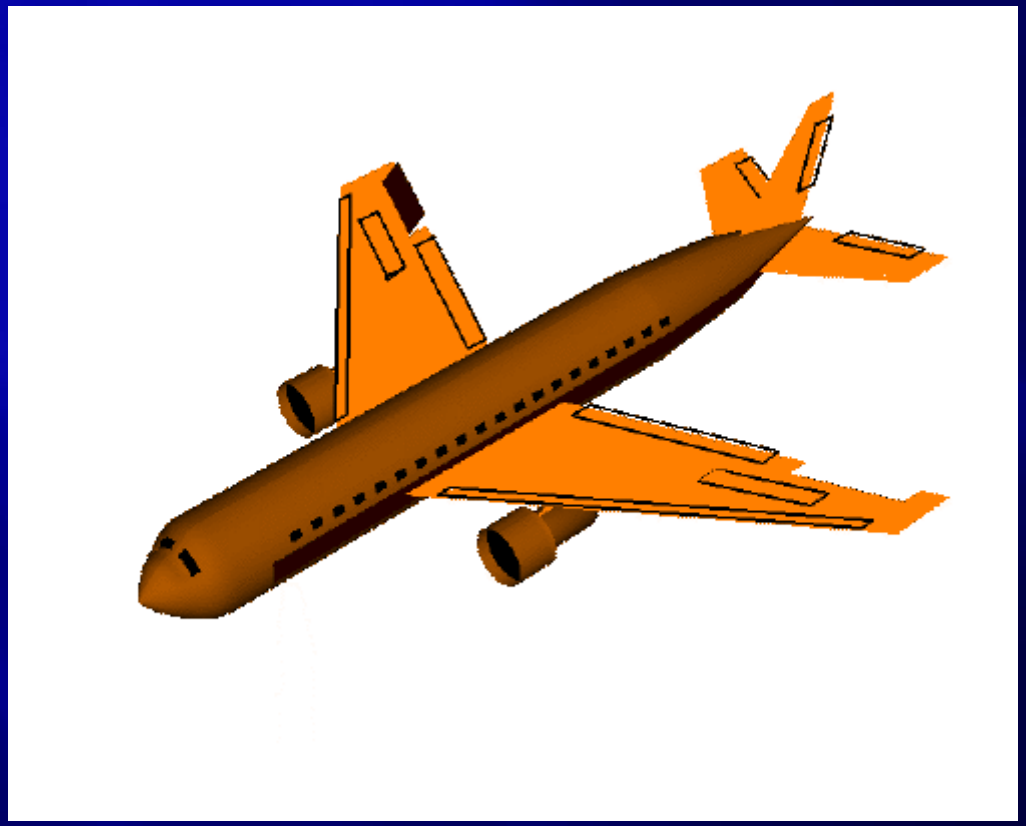


- Longitudinal parameters for State Space model (CHARLIE-1).
- Damping controlled by feedbacks **δE (Kq , Kθ).**
- Analyse the flying quality: criterion and analysis.

PITCH ATTITUDE

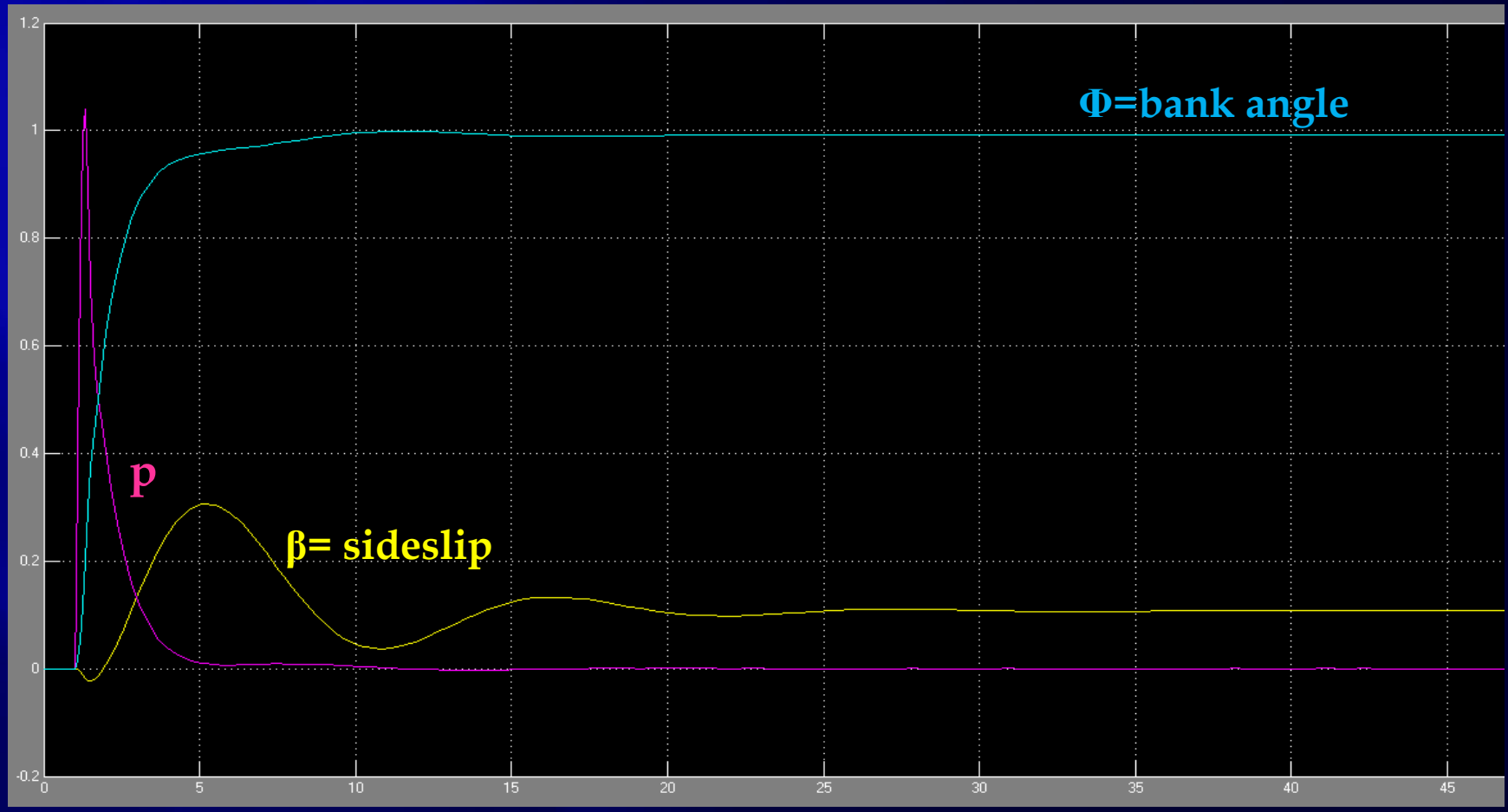


ROLL CONTROL

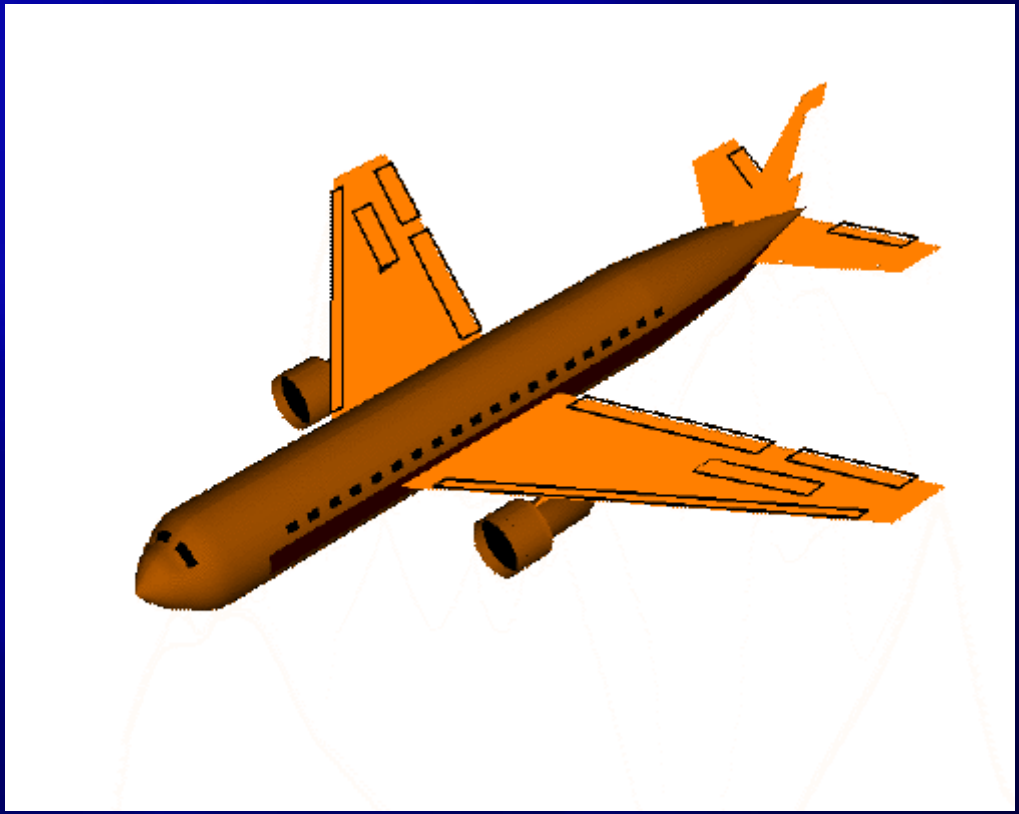


- Lateral parameters for State Space model (CHARLIE-1).
- Choose a control system design : Bank angle control with roll rate inner loop damper.
- Damping controlled by feedbacks: δ_A (Kq,Kc_1,Kc_2 , KΦ).
- Analyse the flying quality: criterion and analysis.

Bank angle control system
With roll rate inner loop damper



YAW CONTROL

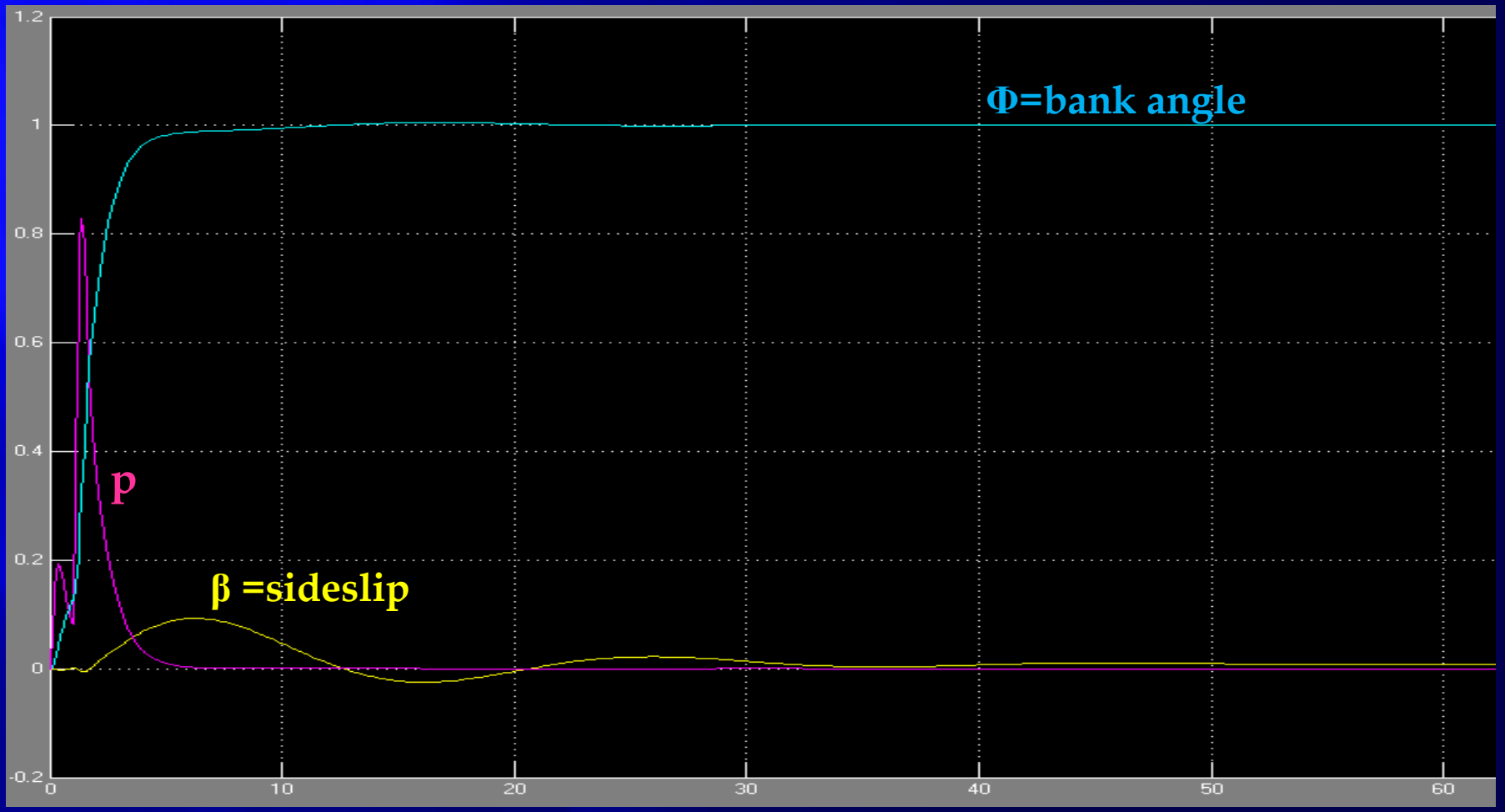


- Lateral parameters for State Space model (CHARLIE-1).
- Choose a control system design : ARI (aileron–to-rudder), to control:
  - Roll rate.
  -The sideslip (yawing moment).

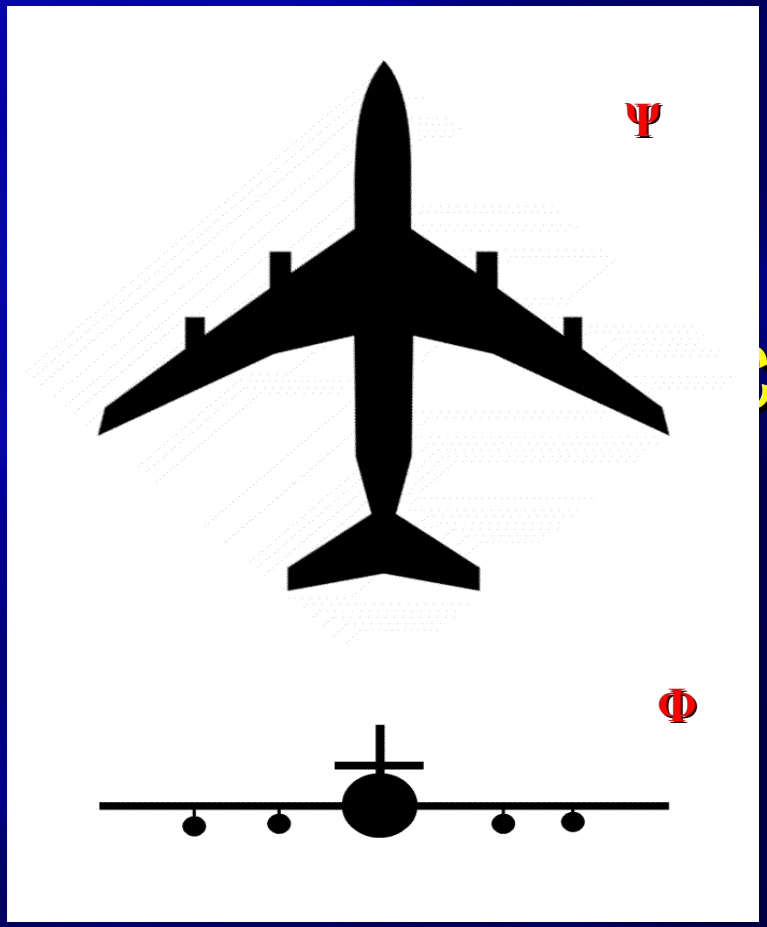
-Control Crossfeed

- **$\delta A + \delta R$ (Kq, Kc_1, Kc_2 , $K\theta$).**
- Analyse the flying quality: criterion and analysis.

ARI SYSTEM
(aileron-to-rudder)



HEADING (Directional systems)

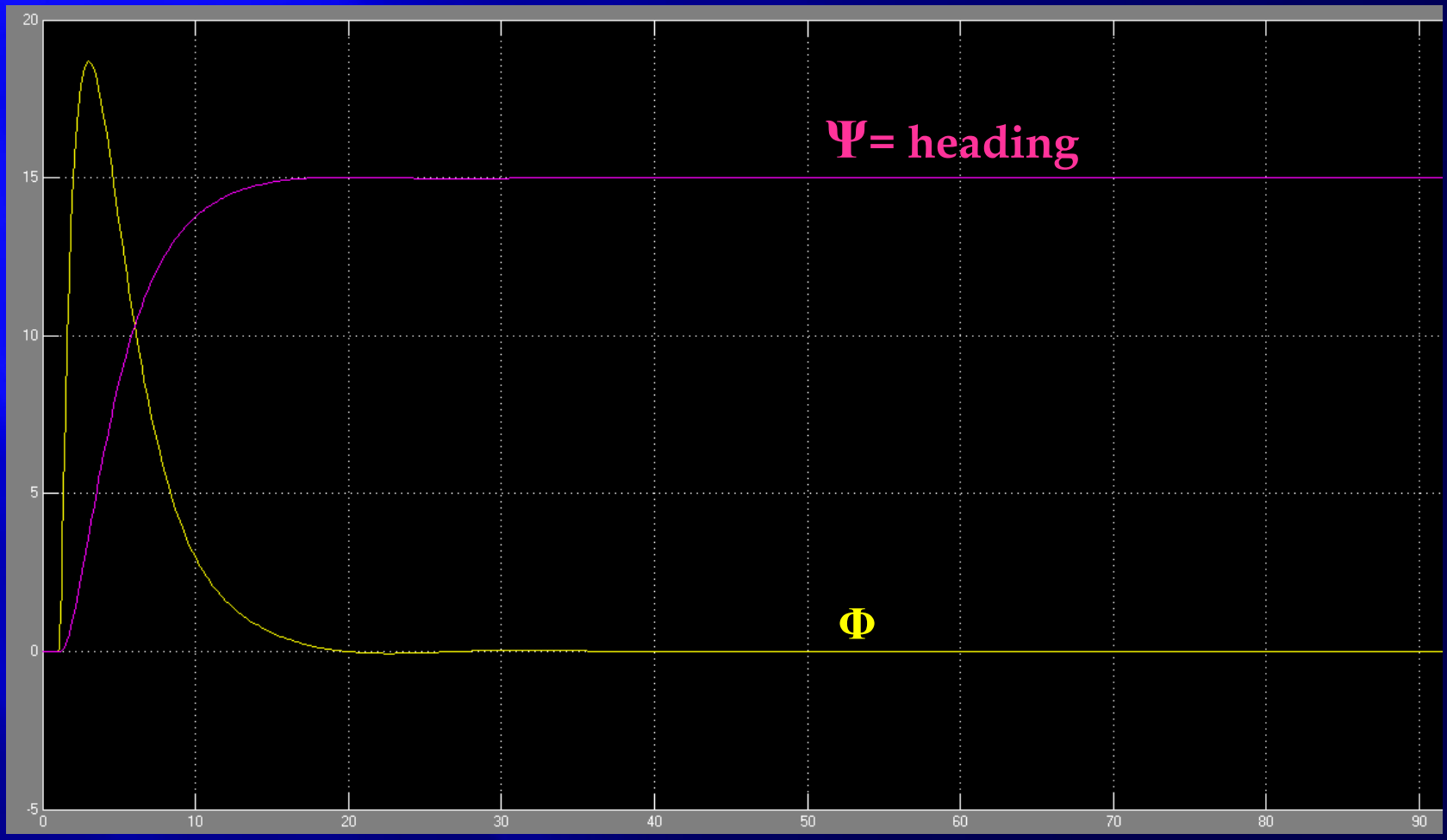


- **Ψ = yaw + coordinated turn.**
  Φ = bank angle.
- Lateral parameters for State Space model (CHARLIE-1).

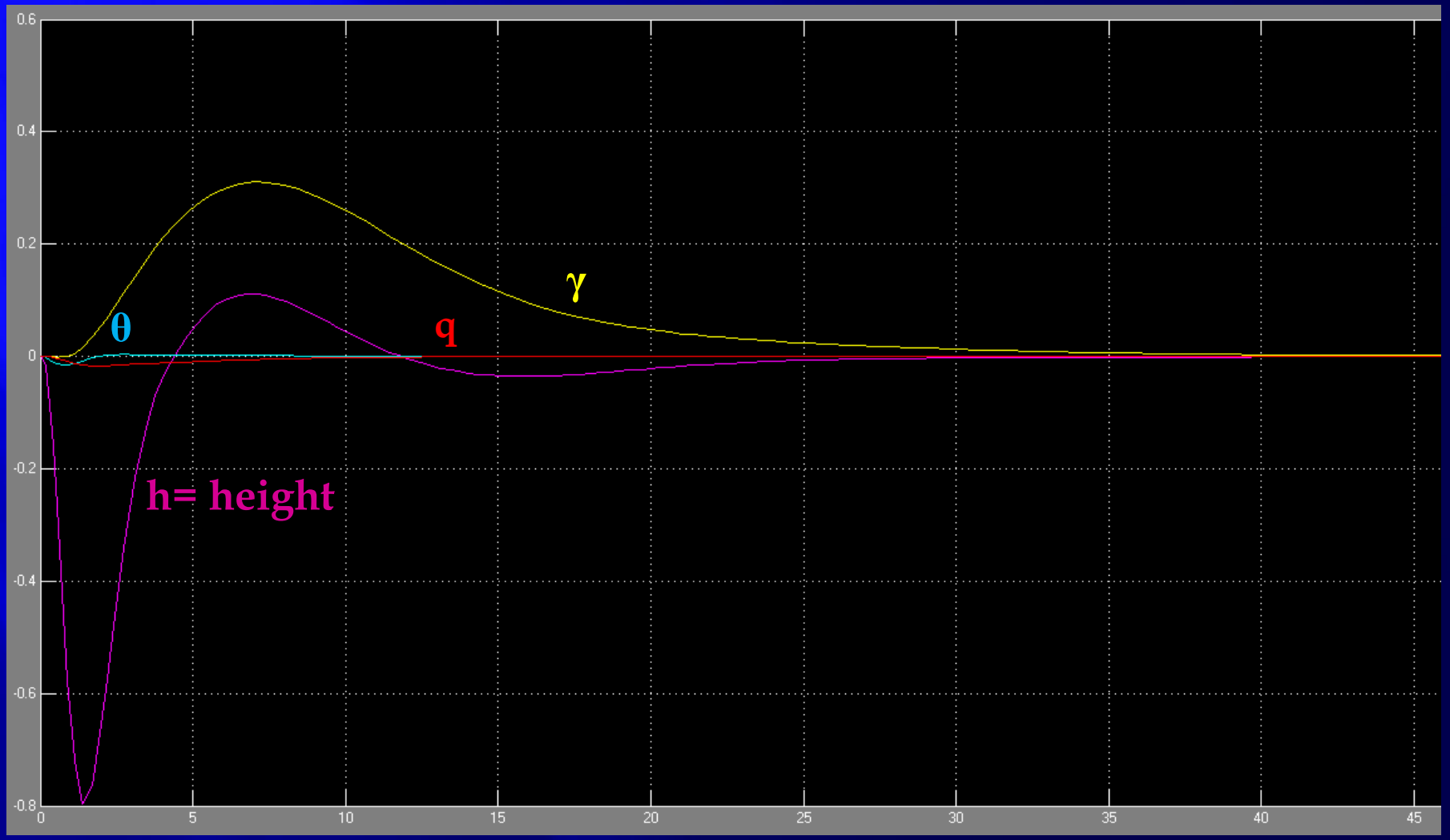
CONTROL SYSTEMS

- Choose a control system design :
  ARI (aileron–to-rudder), as a inner loop.
- **δ_A , δR (Kq, Kc_1, Kc_2 , K_θ, K_Ψ).**
- Analyse the flying quality:
  criterion and analysis.

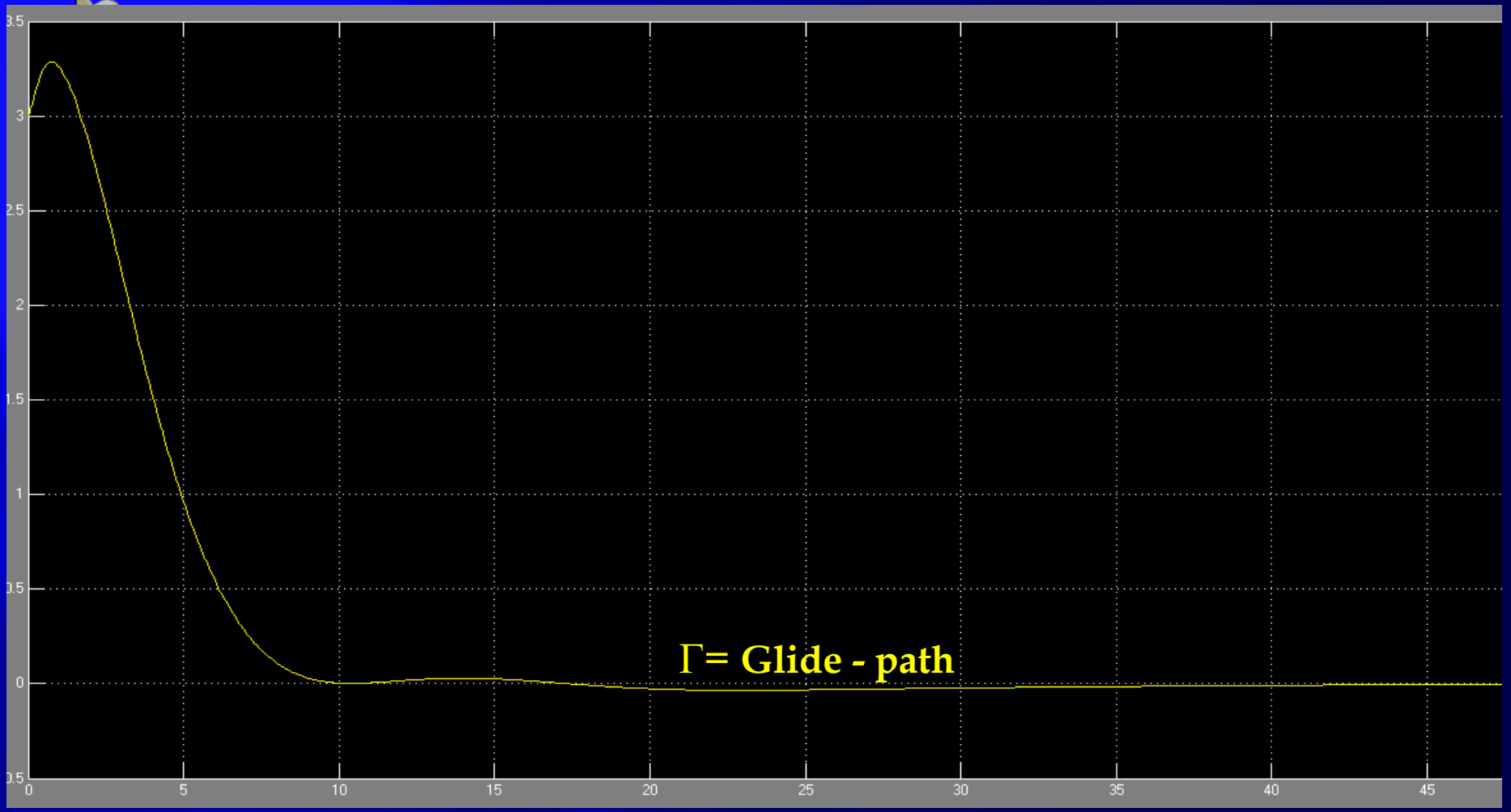
HEADING (Directional systems)



HEIGHT HOLD (Directional systems)



Aproach (Navigational systems)



radio beacon

ANY QUESTIONS?