Altitude control of an aircraft with the presence of faults

Lab work nº2 (part2)

1 Objectives

- To understand the impact of faults in the operation aircraft systems.
- To study methodologies to mitigate the effects of faults.
- To simulate the altitude control in the presence of faults.

2 Introduction

During the operation of a system, faults may happen and if they are not handled properly they can cause a system to fail. Consider, for example, the presence of ice that blocks the intake of a pitot tube or the static pressure intake. Other fault types may occur at other subsystems, for example if data is affected by bit errors, this may led the control system to generate wrong actuation levels.

3 Problems to be addressed

Consider the altitude control loop composed by the air-data computer, the data transfer from air computer to the autopilot and, the actuation of the control surfaces and engine power.

1. Use a simplified 2D model (x, h, vx, vh, path angle) to design an altitude controller. The manipulated variables are the engine power and the angle of attack. Assume that the aircraft speed is such that there is no compressible air effects.

2. Define an altitude control system architecture to detect the presence of faults. If a fault is detected the command should be transferred to the pilot. Make a list of possible faults.

3. Define now an altitude control system architecture that has the capability to detect faults and to choose and use properly functional subsystems. Present a methodology to assess the probability of failure for the proposed control system architecture.

4. For the control architecture of point 3, use a computer simulation model to show the operation of the control system in the presence of injected faults.

4 Evaluation

The following points will be considered in the evaluation of this lab work:

1. Analysis and rationality employed.
2. Results obtained.

Report delivery date: Defined in the first theoretical class.