Exercise no. 1

LEAST SQUARES METHOD

The **lab_02.mat** [1] file contains data collected during two experiments. The data structure for each registered experiment (**data_01** and **data_02**) is the same - the following columns include:

- t - time, s
- a_y - lateral acceleration, m/s^2
- p - roll rate, rad/s
- r - yaw rate, rad/s
- δ_A - aileron deflection, rad
- δ_R - rudder deflection, rad
- β - sideslip angle, rad

Using the Ordinary Least Squares method:

- find stability and control derivatives if aircraft motion is described by the following equations:

$$\begin{aligned} \dot{p} &= L_p p + L_r r + L_{\delta_A}\delta_A + L_{\delta_R}\delta_R + L_\beta \beta + b_{\dot{p}} \\ \dot{r} &= N_p p + N_r r + N_{\delta_A}\delta_A + N_{\delta_R}\delta_R + N_\beta \beta + b_{\dot{r}} \\ a_y &= Y_p p + Y_r r + Y_{\delta_A}\delta_A + Y_{\delta_R}\delta_R + Y_\beta \beta + b_{a_y} \end{aligned} \tag{1.1}$$

- present a comparison of the measurements and estimated time histories for the recorded data
- determine the accuracy of the estimation by providing the relative standard deviations of the stability and control derivatives

References

[1] Jategaonkar R.V., Flight Vehicle System Identification: A time domain methodology, 2 ed., AIAA, Reston, VA, 2015