CDT 22 - Design, Build and Test. Sequential Instabilities for Actuating Aerodynamic Surfaces

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***Abstract*—**

I. Introduction

A. Control Surfaces for Gust Load Alleviation

Gust loads are well known as a source of potential catastrophic failure in aircraft structures; with rare, extreme gusts in particular being a source of the maximum loads that an aircraft may experience. [1], [2]. Aircraft structural requirements are driven by extreme cases to prevent failure, despite operating in far less intense loading environments for the majority of the aircraft's service life [3]. The added capability to cope with extreme gust loads is unnecessary most of the time and comes with an associated parasitic mass increase, which causes reduced fuel efficiency of the aircraft.

Gust load alleviation (GLA) systems aim to reduce the effect of gust loads while minimising mass increase by altering the aerodynamic profile of the wing [4]. Active control surfaces such as ailerons, spoilers have been used to achieve this [4]. However, such control surfaces utilise conventional, active actuation mechanisms such as hydraulic or electro-mechanical actuators [5]. These mechanisms still introduce significant mass and complexity to aircraft which still results in a decrease to fuel efficiency and an increase in cost and manufacture time. A passively actuated GLA system is a mechanism which is able to deploy using the deformation of the wing itself. These are attractive as they are typically simpler and require no external energy [4]. A lightweight, passive GLA system could provide the necessary gust alleviation whilst keeping the parasitic mass added to the aircraft low.

B. Sequential Instabilities

A potential actuation mechanism for a passive GLA system is through the exploitation of structural instabilities. The traditional view on structural instability is largely negative and the presence of buckling is seen as a failure mode.

II. Methodology

A. Equations

Here is an example of an equation:

$$f(x) = x^2 + 2x + 1 \tag{1}$$

B. Tables

Here is an example of a table:

TABLE I: Example Table

Column 1	Column 2	Column 3
Row 1, Column 1	Row 1, Column 2	Row 1, Column 3
Row 2, Column 1	Row 2, Column 2	Row 2, Column 3
Row 3, Column 1	Row 3, Column 2	Row 3, Column 3

C. Figures

Here is an example of a figure:

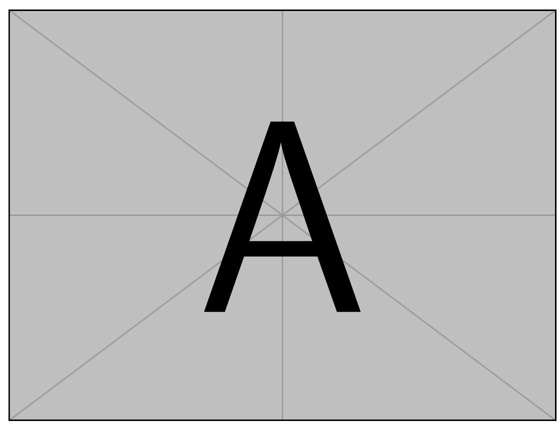

Fig. 1: Example Figure

III. Results

IV. Conclusion

References

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