Bio-Inspired Distributed Sensing for Improved Flight Control

Sergio A. Araujo-Estrada

Research Associate
Aerospace Engineering Department
s.araujoestrada@bristol.ac.uk

Overview

Motivation: Why I chose this area of science

Please explain why you chose to investigate this particular aspect of science, computing, or engineering.

- Intrinsic nonlinear dynamics
- Classic control strategies limitations
- Limitations of inertial controls
- Gust alleviation
- Aeroelastic effects
- Additional'Hidden' information

Previous Research

Explain all of the previous research youve done about this issue/challenge...

A block

What was the goal of your previous research? Be sure to explain how you found it and anyone who might have helped you!.

The problem or challenge

Please explain the question or problem that you investigated.

- Measure, acquire and process flow and load information
- Utilise it for flight control

The hypothesis (or prediction)

What do you think will happen?

- AoA, Windspeed aero loads compuation/prediction/estimation
- Characterisation of pressure, strain & force signals as function of α, V & δ_{ail}
- Acquisition of training/testing daat sets for ANN for α, V & δ_{ail} prediction
- Identification of stall characteristic markers in pressure & strain signals, e.g. frequency, variance
- Acquisition of pressure & strain characteristic response to change in q
- Explore pressure & strain response to conditions similar to perching manoeuvre
- Emulation of pressure & strain response to gusts
- Identify pressure & strain response to varying q, i.e. $\dot{q}$
- Vibration of wing has been observed during and after stall. How does this affect pressure & strain signals?
- Identify pressure & strain response to varying δ_{ail}, i.e. $\dot{\delta}_{ail}$

Experimental Setup

A wing model was instrumented with a distributed array of sensors. The main characteristics of the instrumentation are as follows:

- chord-wise array of 30 pressure ports in two sections along the span
- span-wise array with 16 strain gauges
- data acquisition system using MCU, sampling $100\,\mathrm{Hz}$
- 1-DOF pitch motion wind tunnel rig
- servo system for automated motion

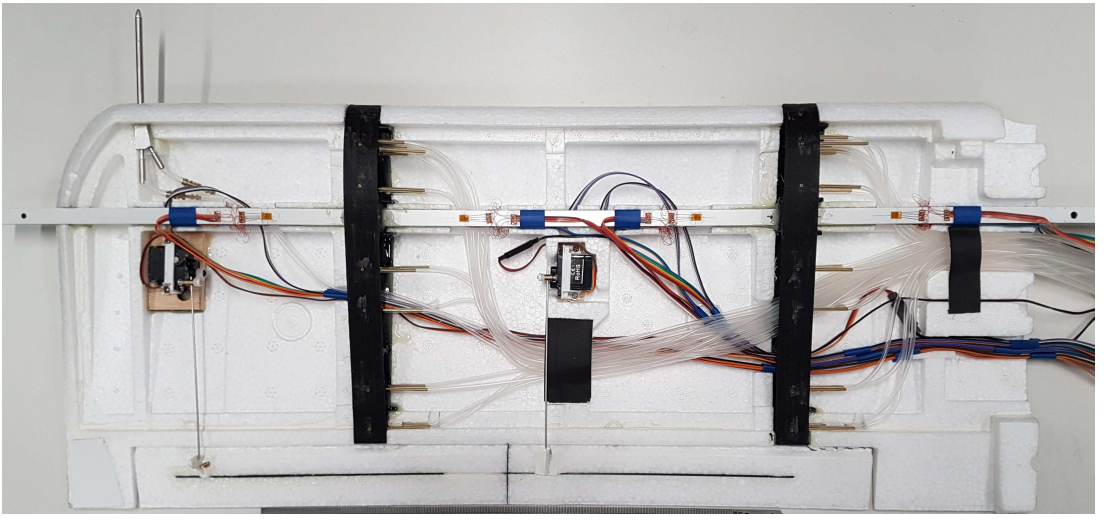
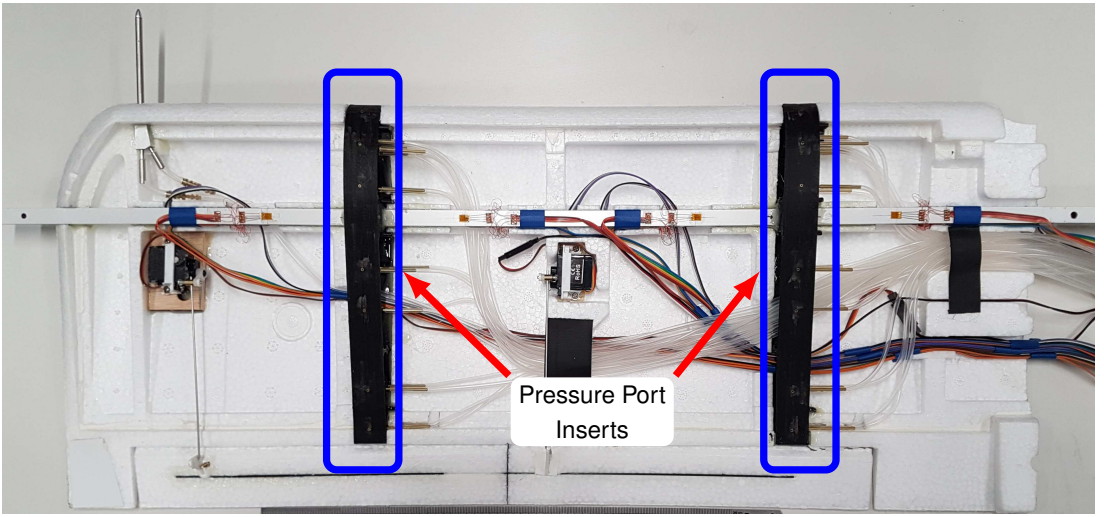


Figure: Wing model experimental platform



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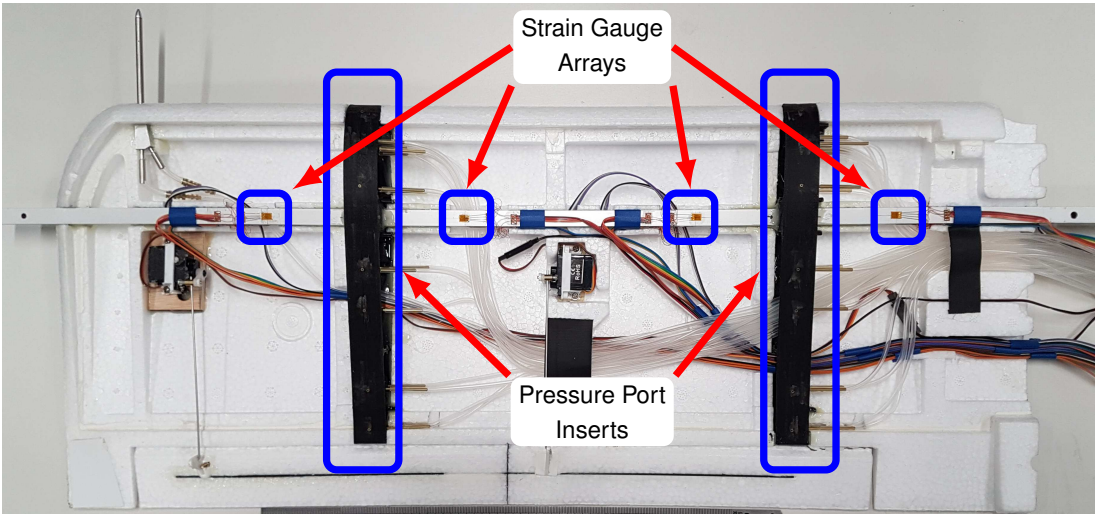

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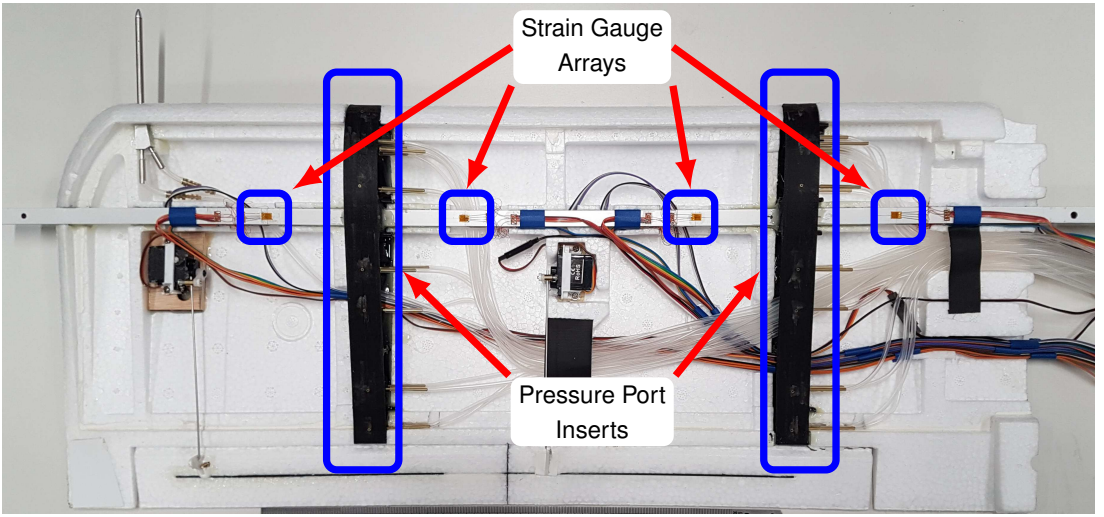

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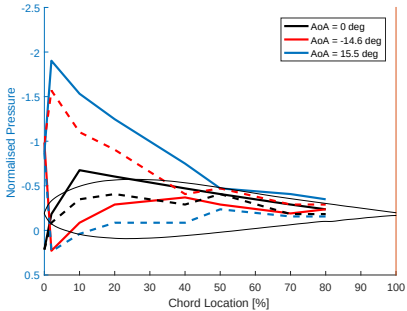
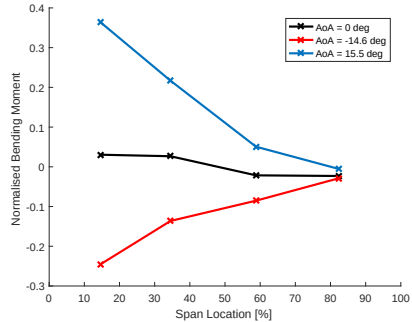
Experiment results

Record the information you get from your experiment.



(a) Chord-wise Normalised Pressure



(b) Span-wise Normalised Bending Moment

Figure: Characteristic signals from distributed sensing array

My discoveries

What did you learn after testing?

- These will get revealed one by one

My discoveries

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  - Indented bullets

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  - Some more indented bullets

My discoveries

What did you learn after testing?

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- Another bullet point

My discoveries

What did you learn after testing?

- These will get revealed one by one
  - Indented bullets
  - Some more indented bullets
- Another bullet point
- Yet another bullet point

This is the most important takeaway that everyone has to remember.

Conclusions

What is the conclusion of your experiment? Did the results support your hypothesis or predicted outcome? How will your findings help the area of science youve researched?

Further Work

What will you do with your findings next? How will you further your research/findings?