Building a robotic bird flapper

Background

Birds are better at flying than any similar sized flying vehicle man has ever constructed. Bird wings are unique with the wing surface being built from individual feathers attached to the skeleton. Unlike airplane wings bird wings have the ability to perform complex flapping motions and to morph their wings - change their shape and area. Morphing provides birds with a unique ability to alter the aerodynamic properties of the wings, but our understanding of the exact effects of wing morphing is poorly understood.

This project concerns designing and building a robotic bird flapper that can be used to mimic bird flight to test the effect of morphing on the aerodynamic performance.

Project

In the first part of the project you will design and build an advanced robotic flapper, which will be attached to the wall of a wind tunnel. The flapper will have mode degrees of freedom and will be able to perform a more naturalistic wing motion than any previous robotic flapper.

In the second part of the project you will determine the wing motion of live birds and set up the control routines so that natural wing motions can be achieved along with desired changes in motion.

Depending on your background there may also be an option of conducting flow measurements using PIV to test the aerodynamic effects of alterations in wing motions.

Figure 1. Bird flight involves flapping and morphing wings that has a large impact on the aerodynamic performance. In this project you will build a robotic flapper to mimic this complex motion of bird wings.

Relevance

This project is part of a basic research project aimed at understanding the aerodynamic control of bird flight and the robot will be used to test hypotheses regarding kinematic variations on aerodynamic performance. Flapper design and knowledge about aerodynamic performance may also influence micro air vehicle design.

Deliverables

- Robotic flapper of a morphing bird wing
- Control routines for generating a realistic wing motion and altering specific aerodynamically relevant parameters
- Aerodynamic measurements to compare with wakes of real birds

Contact

The project will be conducted at Lund University in Sweden. Employment during or as an elongation can be provided for a limited period.

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