Wing folding fuselage and elbow
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Content

• Folding wing
  • Previous state → aluminium pieces and simulations
  • Experimental results and future work
• Fuselage (in collaboration with CATEC)
  • Current state
  • CATEC optimisation
• Elbow (in collaboration with Cristina and Mar)
  • Iterations
  • Current work Equations?
  • Experimental results
• Bonus: Optitrack post-processing algorithm
Folding wing

Previous state

174 grams added
1/3 volume reduction
Folding wing
Experiments
Flapping April 2021
Folding wing

Aluminium pieces – CATEC  Piece redesign after broken in flight
Folding wing

Flapping simulation
Folding wing

Flapping simulation
Folding wing

Flapping simulation
Folding wing
Folding simulation
Folding wing

Folding simulation
Folding wing

Experiments
September 2021
Folding wing
Experiments
September 2021

Controlled by Jesús
Recorded by Toni
Folding wing

Aluminium pieces – CATEC

Piece redesign after broken in flight
Folding wing

Future work

• CATEC: Aluminum pieces
• Repairing the wing
• Experiments:
  • Folding after a flight
  • Improving folding time of 15s
  • Folding during flight
  • Flying in automatic with Optitrack
• Publishing in a journal
• Feather wing version
Fuselage

Current state – previous optimisation

- 130 grams without optimization
- 20 grams only the head
- Performing iterations with CATEC
- Easily replaceable head
Fuselage

CATEC optimisation

- Load calculations → honeycomb pattern
- Added bolts
- About 70g without head
- Carrying tests
Fuselage

Future work

• CATEC:
  • Finishing tests
  • Manufacturing the fuselage
• Experiments for demonstrate the endurance:
  • Gliding
  • Front impact (in head)
  • Flapping (to assure the ornithopter can fly carrying the fuselage weight)
• Feedback to CATEC
Elbow

With Cristina, Mar and Jesús
Elbow
With Cristina, Mar and Jesús

Iterations
Elbow
With Cristina, Mar and Jesús

Current work

- First printing attempt
- Our Ultimaker 3D printer

- TPU material
- Our Ultimaker 3D printer
- Next attempts

- TPU material
- Ingeniería 3d digital
- 12.9 g, 45°
Experiments

- September 2021
- Bench
- Flight
Elbow
With Cristina, Mar and Jesús

Future work

• Simulations
• Testing different angles of the TPU pieces and associating their respective operating frequency
• Receiving and testing the silicon pieces asked to CATEC
  • Expected to be more isotropic and stronger
  • Not to plasticize after several flights.
**Bonus:** Optitrack post-processing algorithm

*With Cristina*

**Problem**
Bonus: Optitrack post-processing algorithm

With Cristina

Solution

- From Optitrack:
  - Conduct an experiment with labeled markers
  - Export data to a .CSV

- In MATLAB:
  - Import data
  - Recognise Labeled and Unlabeled Markers
  - Iterate for each of the Unlabeled Markers
    - For its first matrix of numbers → Find an adequate hole in the labeled markers
    - If more than one possible hole → Find the minimum difference
    - If there aren’t any adequate holes → Use the next matrix of numbers
    - At last resource, between maximum and minimum values of the markers
    - Check if the difference is under a tolerance
      - No: use the next matrix of numbers
      - Yes: replace NaN values of the marker for numbers of the Unlabeled Marker
Thanks for your attention

ANY QUESTIONS?