Flexible Airplanes?
Achieving higher fuel efficiency by continuously adapting wing geometry
Andrés E. Rivero*

Problem

2.5% of total CO₂ was emitted by aviation industry in 2019
120% increase in fuel burn by 2045

Climate Emergency
Severe consequences for the environment

Technical Problem
Hinged flap
Highly turbulent wake
Sharp, discrete and discontinuous changes in wing geometry

High Drag
Caused by surface discontinuities & gaps

Higher Fuel Consumption & Noise

Technical Solution
Camber Morphing
Smooth & continuous changes in wing geometry

16% to 50% lower drag
Compared to a hinged flap
3% to 6% lower fuel burn
If implemented in commercial airliners

More research is needed
To scale technology up to meet industrial standards

Fish Bone Active Camber (FishBAC) device

How can it deflect continuously?
Combination of stiff and rigid components (e.g. carbon fibre plate) with flexible ones (e.g. silicone rubber sheet)

How was it made?
Manufacturing techniques: 3D printing, machining, composite hand layup

How do you simulate its behaviour?
Developed novel & bespoke structural and aerodynamic mathematical models during PhD

How was it tested?
Structural and wind tunnel experiments to study its structural & aerodynamic behaviour

*Bristol Composites Institute, University of Bristol.
andres.riverobracho@bristol.ac.uk

Video here!
Shape Adaptive Blades for Rotorcraft Efficiency

bristol.ac.uk/composites