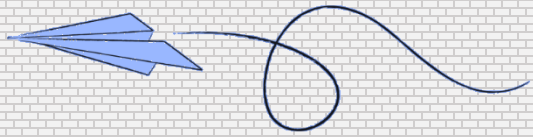


3D-Printed Morphing Wings for Controlling Yaw on Flying-Wing Aircraft

Benjamin C. Moulton, Graduate Research Assistant

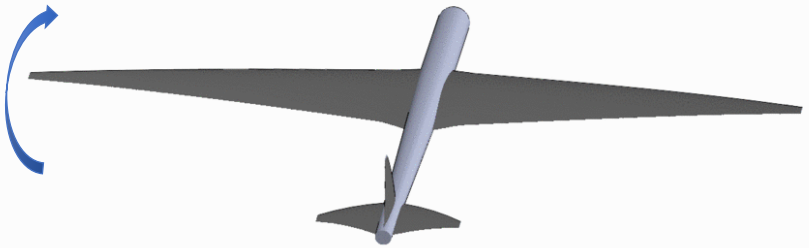
Douglas Hunsaker, Assistant Professor

Mechanical and Aerospace Engineering, Utah State University

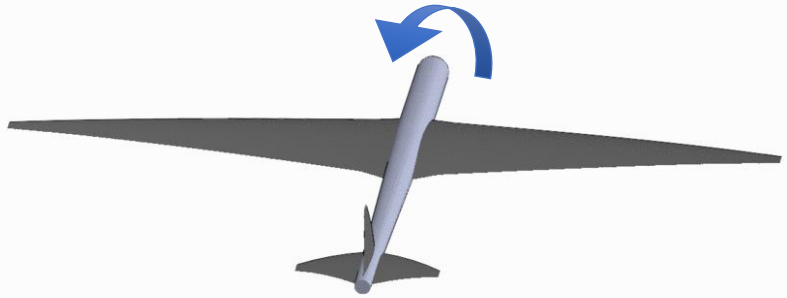
Photo : Kirill, Unsplash (used with permission)

Airplane Axes of Motion

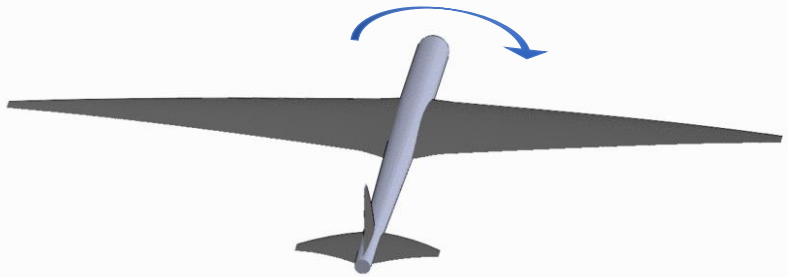
Roll



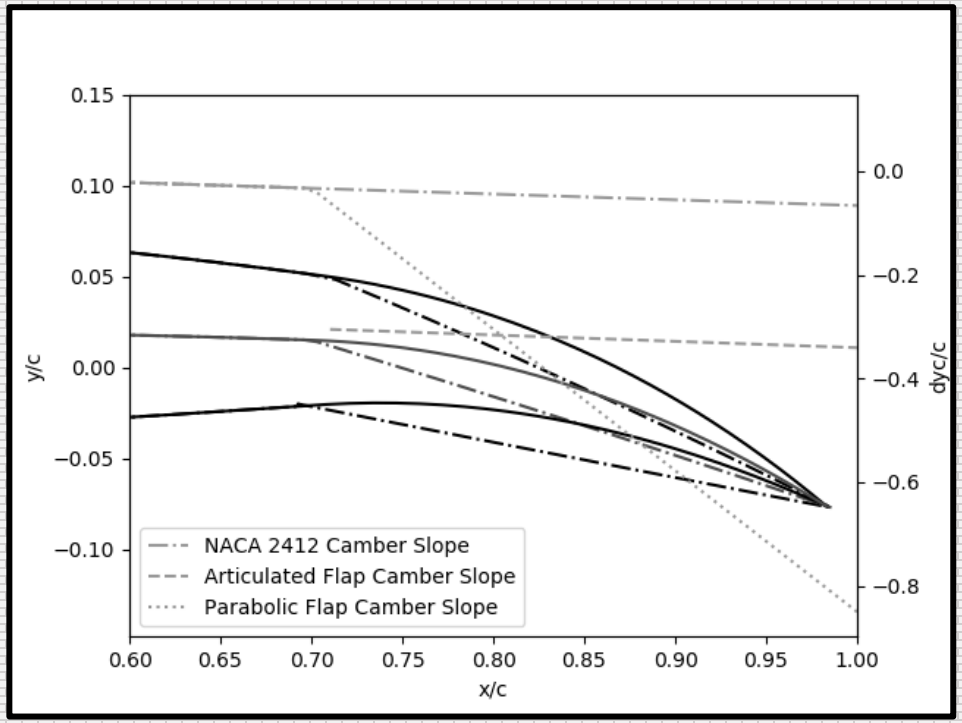
Pitch



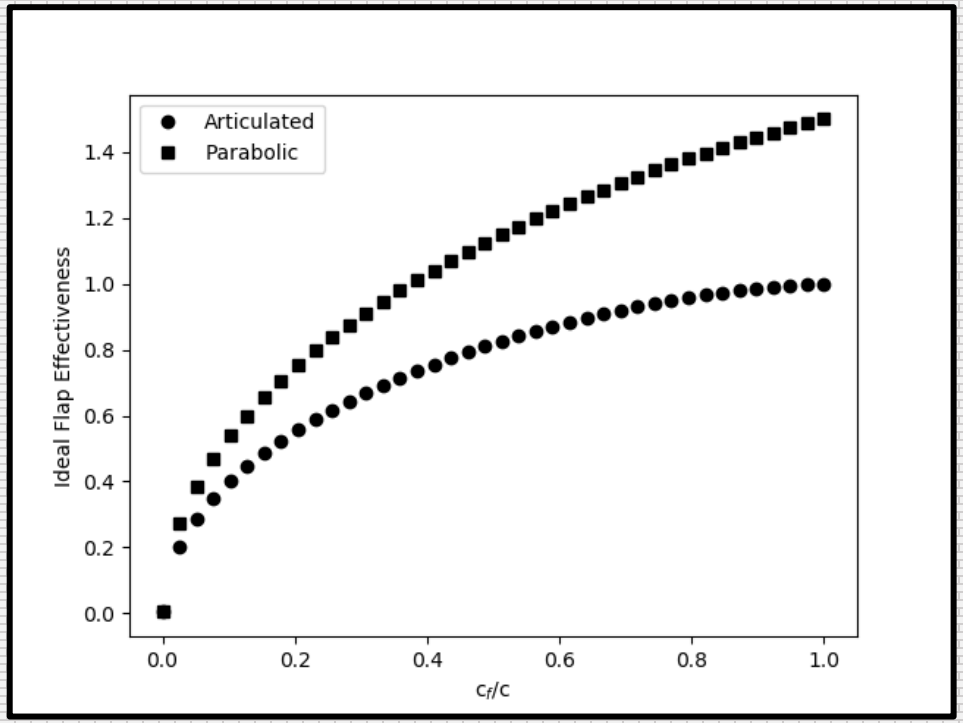
Yaw



Parabolic and Articulated Flaps

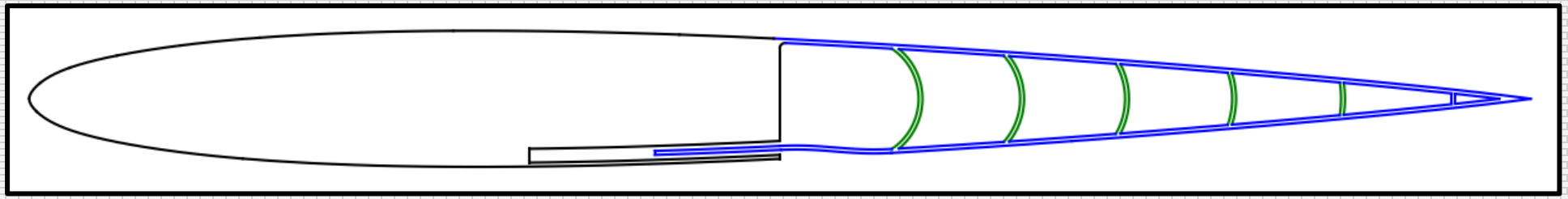


Camber-line slope discontinuity

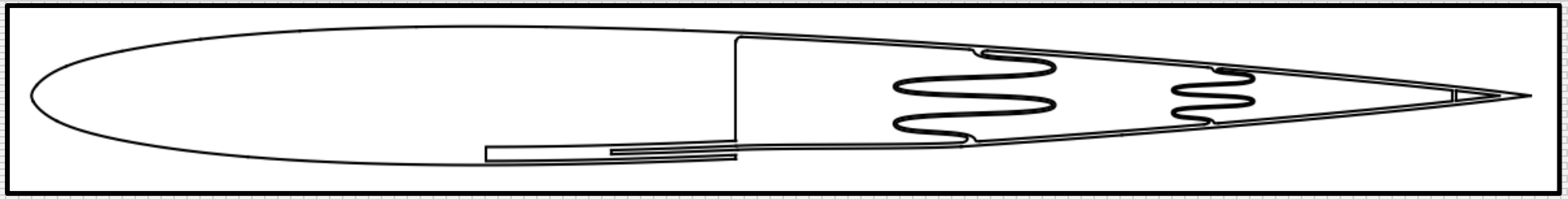


Increased flap effectiveness

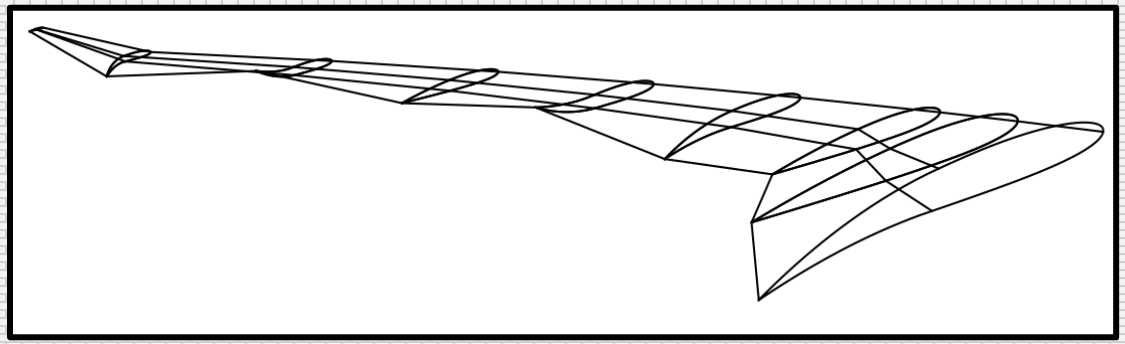
Airfoil Recambering Compliant System (ARCS)



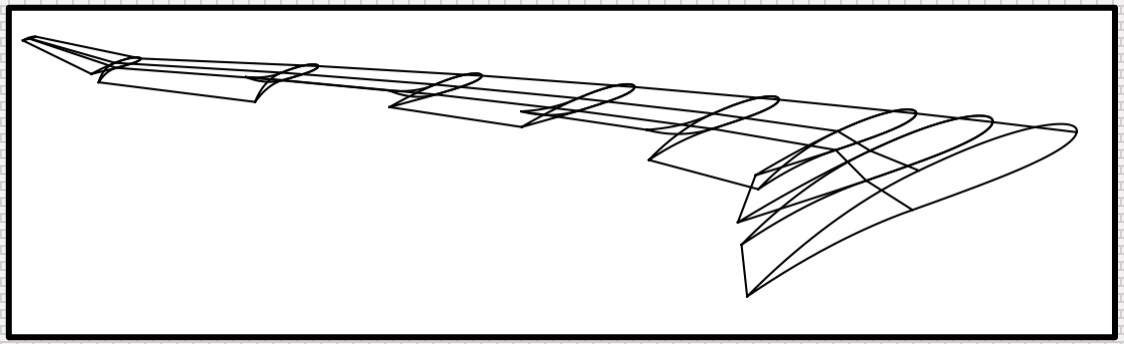
Kinetic Internal Nexus Compliant System (KINCS)



Continuous and Discrete Control-Surfaces

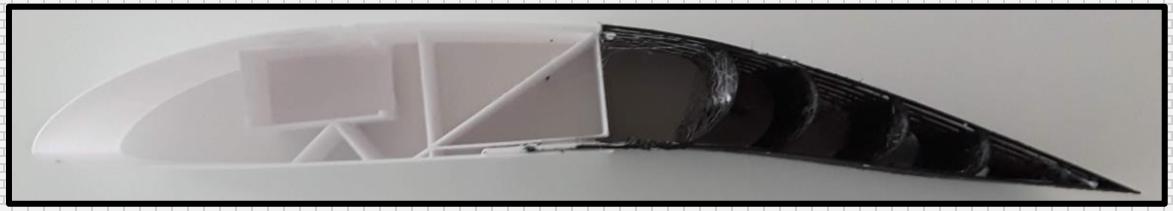


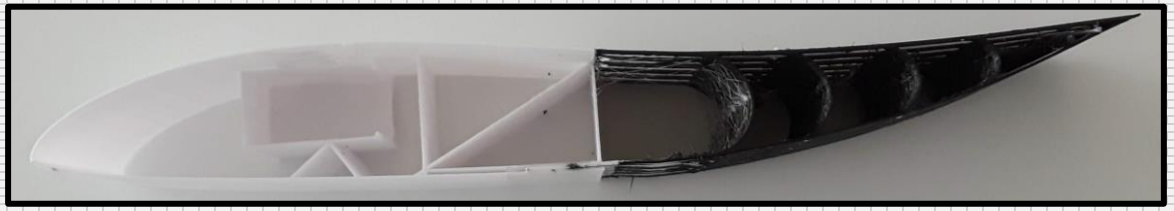
Continuous control-surface drawing

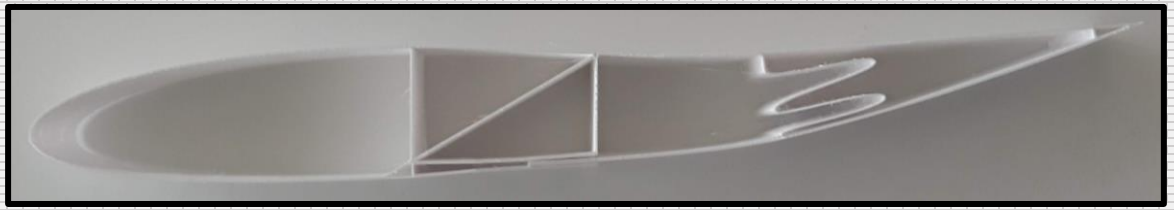


Discrete control-surfaces drawing

Morphing Airfoil FDM Prints



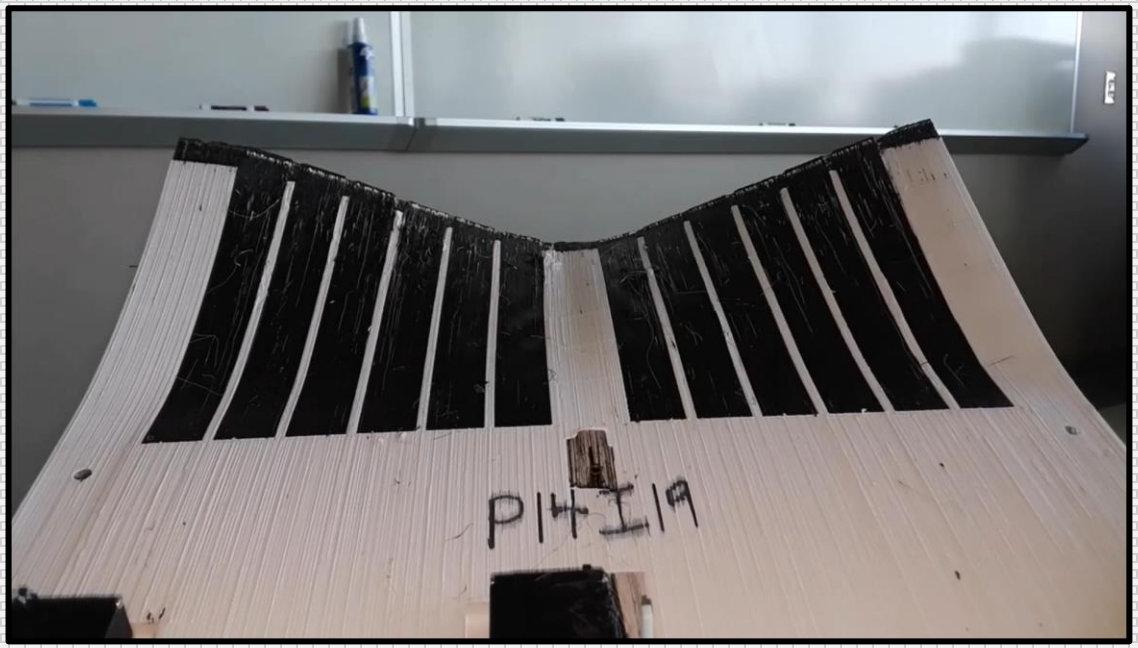




+15° Deflection

-15° Deflection

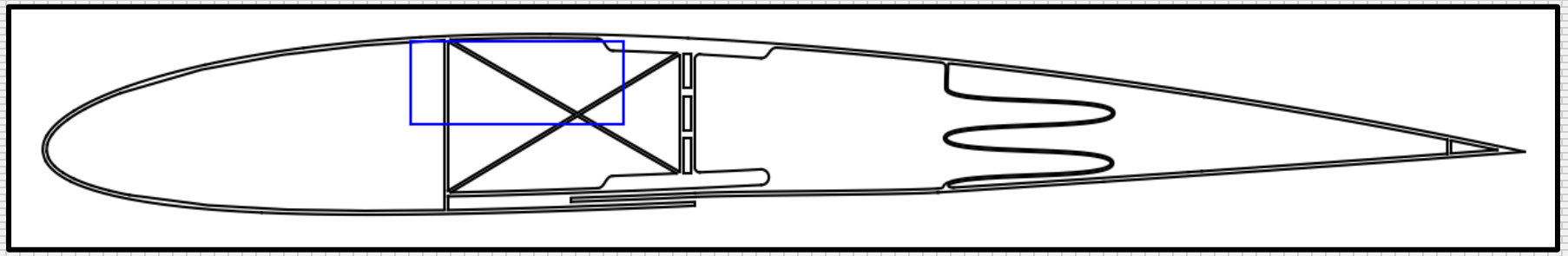
Morphing Wing FDM Prints

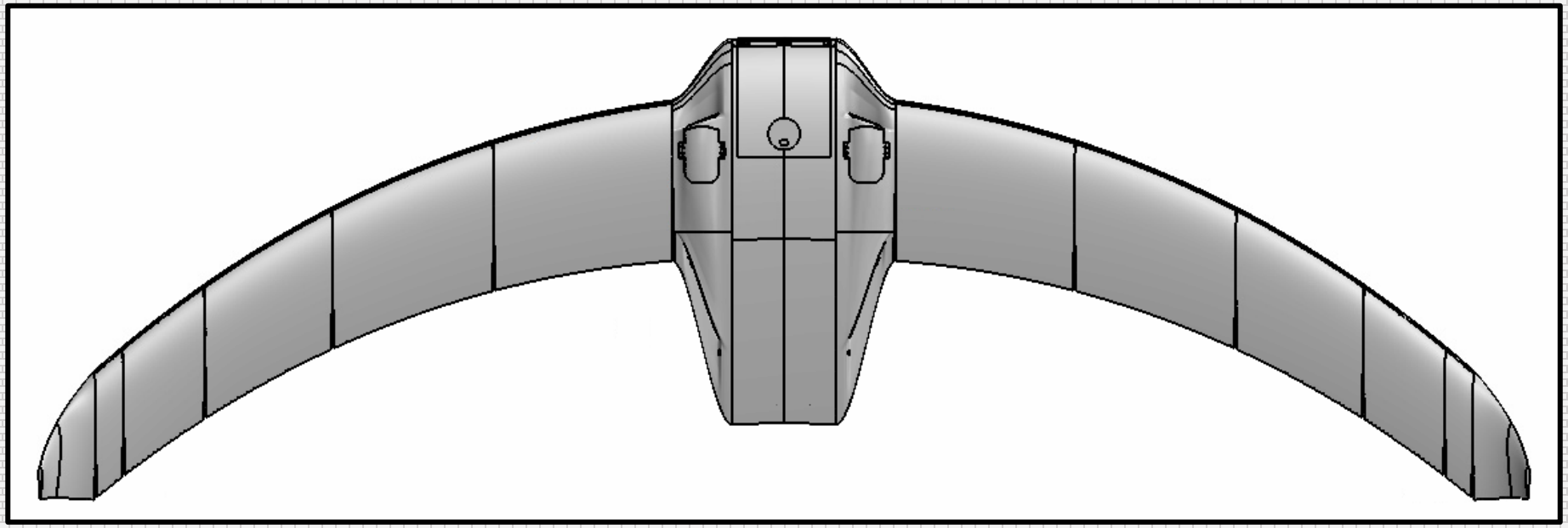


ARCS – Continuous

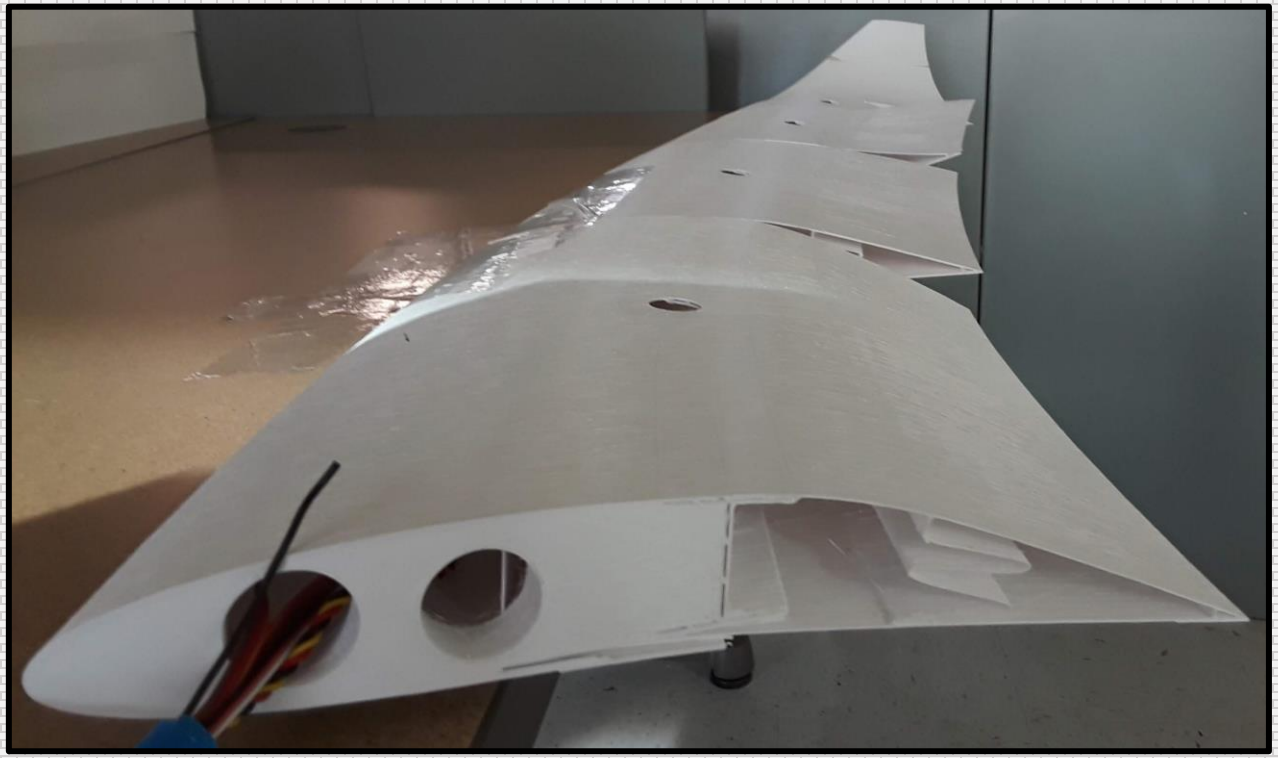
KINCS – Discrete

Final Design – Discrete Flaps with KINCS

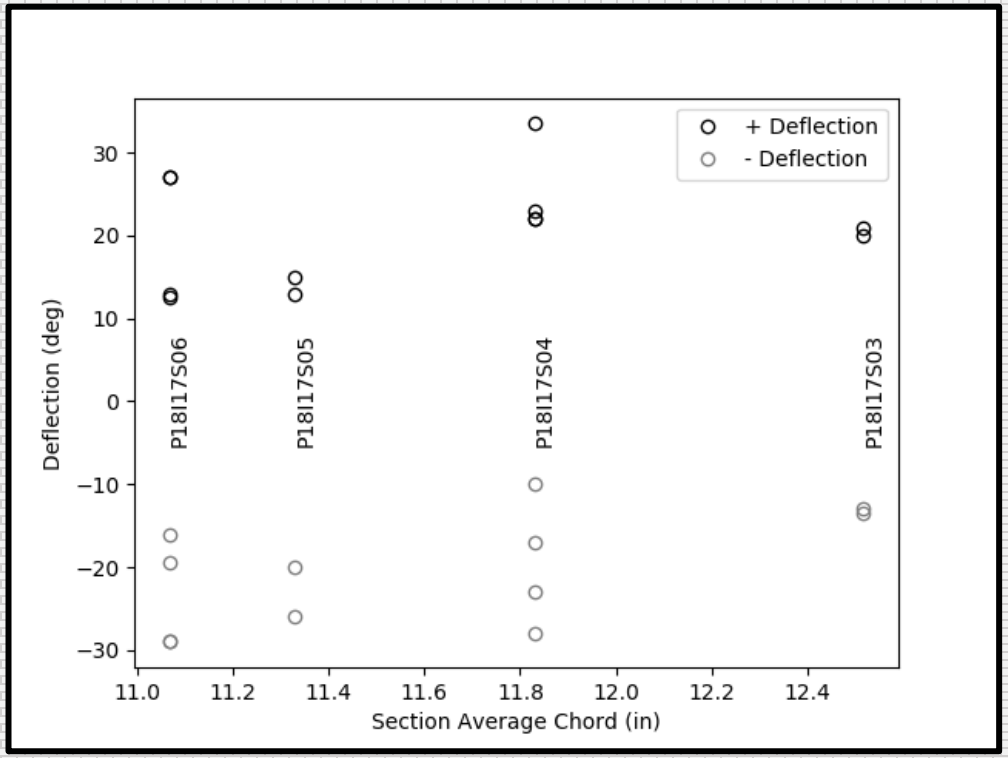




Final Design – Deflection Results

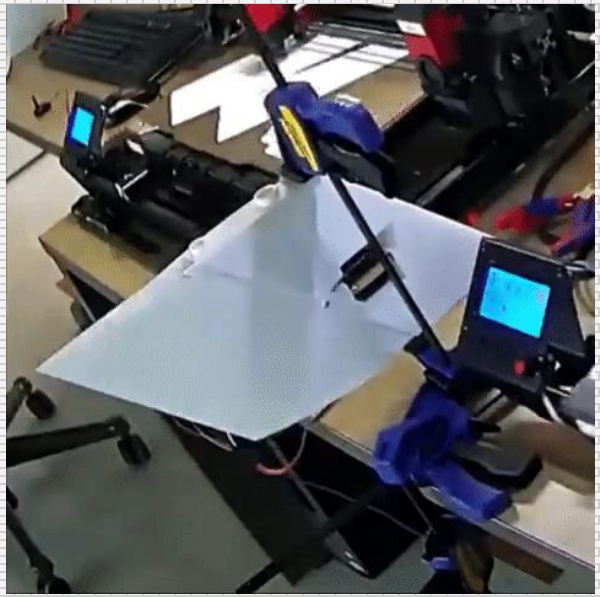


Horizon Discrete Flaps with KINCS Mechanism



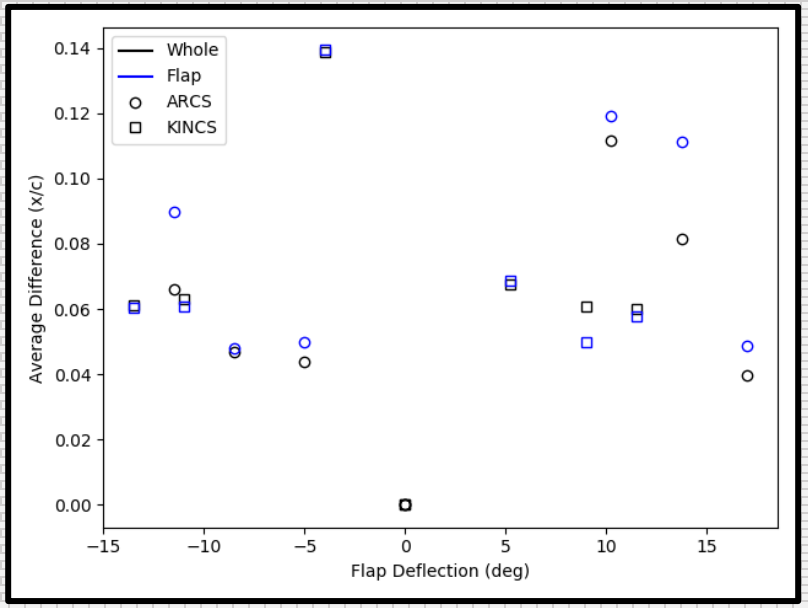
Servo Actuated Deflections

Final Design – Fatigue, Parabolicity and Load Results



Fatigue

Load

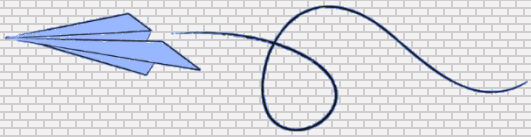


Parabolicity

Conclusion

ARCS – Continuous flaps – 15° difference gradient

KINCS – Discrete flaps – $\pm 25^\circ$



For More Information:

Moulton, Benjamin C., "3D-Printed Morphing Wings for Controlling Yaw on Flying-Wing Aircraft" (2021). *Thesis*.

Moulton, B. C., and Hunsaker, D. F., “3D-Printing Wings with Morphing Trailing-Edge Technology,” AIAA SciTech 2021 forum, Control ID 3435339.

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