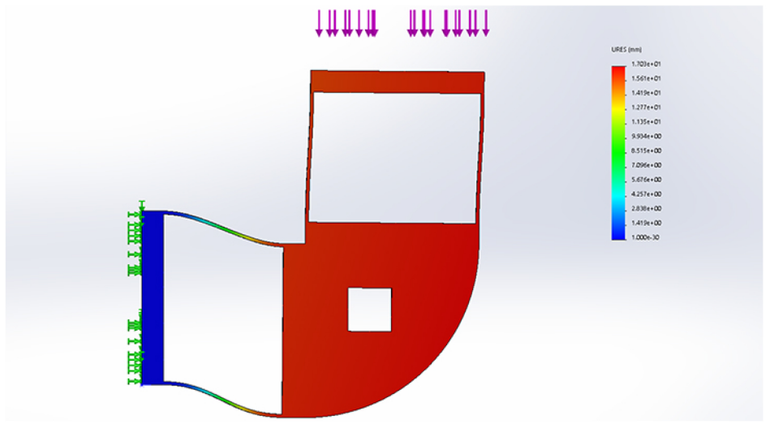
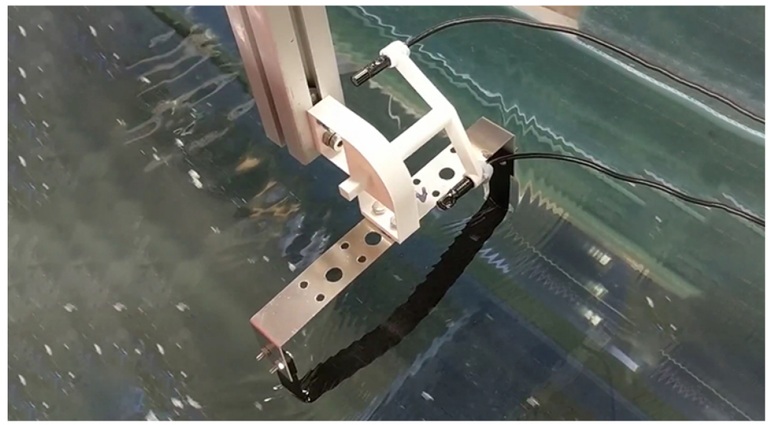
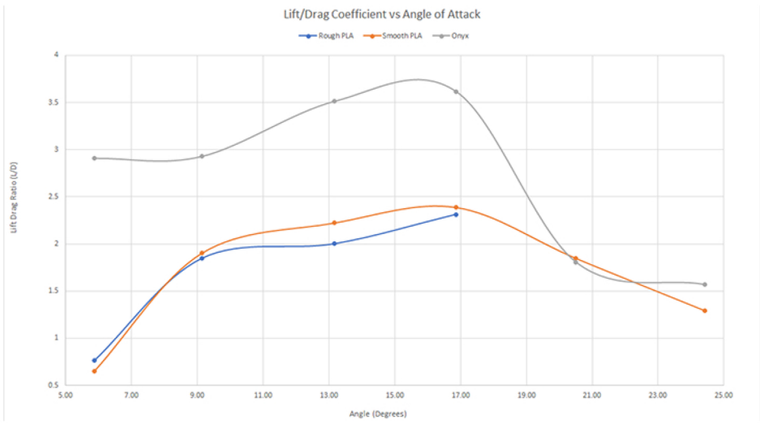
Performance of 3D Printed Hydrofoils

for use in Experimental Testing







PROJECT

The aim of this project was to investigate whether the 3D printing of hydrofoils is a viable option for scale model testing. This topic was selected to help fill the gap in hydrofoil research and to reduce its expensive nature.

This project aimed to complete this task by manufacting 3D printed hydrofoils with PLA and Onyx filaments. This allowed comparisons and possible benefits of each material to be analysed.

Research into the surface finishes of the produced models was also tested against each other. This enabled attributes to be compared for possibility of use in commercial research.

The potential benefits this method yields against its alternatives are noted and analysed for usability in industry. The main aim of the investigation was to find less expensive modes of hydrofoil research, which is achieved in this report.

METHODOLOGY

The printed foils were tested in a 20m flume with their lift and drag forces measured to compare with the characteristics of full-scale hydrofoils.

The foil set was designed in Solidworks to represent a NACA 63-412 scaled foil.

Forces were measured with a tailored 3D printed compliant load cell and analysed using video editing software. The load cell's accuracy and precision were analysed to relate to the credibility of the investigation's results and conclusions.

Deflection in the load cells was recorded using endoscopes; this footage was later analysed in Adobe Premier Pro. A mark on the load cell was tracked in the editing software and the number of pixels the mark moved under each load was recorded. This movement was related with calibration data to achieve accurate lift and drag forces from the foil.

RESULTS

The results found have been graphically analysed to allow observations to be drawn from the data. The analysed results show strong correlations to full-scale hydrofoil characteristics.

The calibration data recorded from the load cells demonstrate relatively constant relations between deflection and applied loads. Accuracy and precision of data recordings from the load cell is uncertain and could benefit from further study.

Analysis into the load cell calibration shows that the deflection gradient is constant, however the sensitivty of the data is between 15% and 35.51%.

The foil sets functioned as expected with realistic lift and drag values. An unexpected outcome was the far greater Lift:Drag ratio that the Onyx foil had over the PLA foils.

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