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Abstract #
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A Simplified Digital Twin Framework of a Trainer Aircraft to Enhance Flight Testing

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Abstract

The purpose of a Digital Twin can vary depending on the application, but most of the time a Digital Twin enhances the implementation of an engineering product or system in a way that a physical product alone never could, or it would require too many resources to get the same results without a Digital Twin [1].

In this paper, work has been undertaken to build an easy-to-use framework for a Digital Twin of a Pilatus PC21 jet trainer, to learn and predict the behaviour of the trainer aircraft using a neural network. The intention of the Digital Twin Framework is to predict how the aircraft performs in different maneuvers, or more specifically how the aircraft reacts to a given control input.

With such a Digital Twin the design process and the certification of aircraft could be enhanced in such a way that only a limited amount of real flight data is required to predict its behaviour with only the manoeuvres predicted to be critical being necessary to be tested physically. Consequently, there would be a reduced need for expensive and time-consuming physical testing.

The Digital Twin was implemented using MATLAB code supported by a Simulink model. For training the Digital Twin using a neural network, real flight data of a Pilatus PC21 provided by ETPS/QinetiQ was used. The simple version of the Digital Twin demonstrated the improvement in the accuracy of the predictions based on the training data. The predictions were then compared with the real flight data for validation.

The obtained results thus far show that a Digital Twin for an aircraft can be implemented and validated with real flight data to predict the outcome of specific control inputs. Although the predicted outcomes are accurate only within a range of the real outcomes, further improvements in the Digital Twin Structure and training would allow the model to be more precise. The developed Digital Twin framework is simple to follow and gives a chance to simplify the process of designing and testing aircraft in the future.

References

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