MODELLING AND CONTROL FOR LONGITUDINAL DYNAMICS OF AIRCRAFT SYSTEM

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OGOS 2012

3. Acknowledgements

Alhamdulillah, praise be to Allah S.W.T, the Most Gracious and the Most Merciful. To Whom we seek help and guidance and under His benevolence we exist and without His help this research could not have been accomplished. Appreciation and gratitude to all those involved directly and indirectly in completion of this research works.

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Universiti Teknologi MARA

And

All colleague from Faculty of Electrical Engineering and others who have provided assistance at various occasions.

5. Report

5.1 Proposed Executive Summary

Today's aircraft designs rely heavily on automatic control system to monitor and control many of aircraft's subsystem. Development of automatic control system has played an important role in the growth of civil and military aviation. One of the major problems of flight control system is due to the combination of nonlinear dynamics, modelling uncertainties and parameter variation in characterizing an aircraft and its operating environment. In recent years, many researches find that the uncertainty associated with modelling, and the complexity of the nonlinear phenomena present the main challenges in developing flight control systems. Thereby, this research is attempted to study the advanced control strategies required to address the complex nonlinear longitudinal dynamic characteristics of such aircraft. In longitudinal control, it involved pitch axis of an aircraft system and the elevators controls the longitudinal motion. Specifically, the research objective are i) to study the complex dynamics behavior of aircraft system and develop the suitable mathematical model for aircraft longitudinal control and ii) to identify the suitable model parameters in modelling of longitudinal controller of aircraft system and iii) to evaluate and compare the performance of several controllers including modern and advanced control for aircraft longitudinal dynamic. This research is conducted to model the appropriate control schemes for longitudinal control, in order to study the complex dynamics behavior of aircraft system. It begin by define the model for longitudinal controller to describe dynamics of system in a set of differential equation. Several control strategies including modern and advanced control will be developed and performance of the controllers will be analyzed. The model will be validated through simulation using MATLAB. At the end of this research it is expected, to achieve an accurate model representing the actual system behavior. Performance comparison between several control strategies for aircraft longitudinal control also will be reported.

5.2 Enhanced Executive Summary

This project presents dynamics modeling of longitudinal controller based on design an autopilot that controls the pitch of an aircraft. One of the major problems of flight control system is due to the combination of nonlinear dynamics, modelling uncertainties and parameter variation in characterizing an aircraft and its operating environment. In recent years, many researches find that the uncertainty associated with modelling, and the complexity of the nonlinear phenomena present the main challenges in developing flight control systems. Thereby, this research is attempted to study several control strategies required to address the complex nonlinear longitudinal dynamic characteristics of such aircraft. In longitudinal control, it involved pitch axis of an aircraft system and the elevators controls the longitudinal motion. Specifically, the research objective are i) to study the complex dynamics behaviour of aircraft system and develop the suitable mathematical model for aircraft longitudinal control and ii) to identify the suitable model parameters in modelling of longitudinal controller of aircraft system and iii) to compare the performance of several controllers including classical, intelligent and hybrid control strategies for aircraft longitudinal dynamic. This research is conducted to model the appropriate control schemes for longitudinal control, in order to study the complex dynamics behaviour of aircraft system. It begin by define the model for longitudinal controller to describe dynamics of system in a set of differential equation. This project used three approaches in designing controller that consist of classical, intelligent and hybrid controller. Proportional-integral-derivative (PID), Self-tuning fuzzy PID and PID-type fuzzy logic controller are used in this investigation to control the pitch angle of aircraft system. The main motivation behind this research is to investigate which approach provides the best performance base on time response specification and disturbances rejection. Through the simulation in Matlab and Simulink results shows that the hybrid control, PID-type fuzzy logic controller perform the best performance compared to Proportional-Integral-Derivative (PID) and self-tuning fuzzy PID.

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