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Pilot Induced Oscillations Adaptive Suppression in Fly-By-Wire Systems

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Abstract : The present work proposes the development of an adaptive control system which enables the suppression of Pilot Induced Oscillations (PIO) in Digital Fly-By-Wire (DFBW) aircrafts. The proposed system consists of a Modified Model Reference Adaptive Control (M-MRAC) integrated with the Gain Scheduling technique. The PIO oscillations are detected using a Real Time Oscillation Verifier (ROVER) algorithm, which then enables the system to switch between two reference models; one in PIO condition, with low proneness to the phenomenon and another one in normal condition, with high (or medium) proneness. The reference models are defined in a closed loop condition using the Linear Quadratic Regulator (LQR) control methodology for Multiple-Input-Multiple-Output (MIMO) systems. The implemented algorithms are simulated in software implementations with state space models and commercial flight simulators as the controlled elements and with pilot dynamics models. A sequence of pitch angles is considered as the reference signal, named as Synthetic Task (Syntask), which must be tracked by the pilot models. The initial outcomes show that the proposed system can detect and suppress (or mitigate) the PIO oscillations in real time before it reaches high amplitudes.

Keywords : adaptive control, digital Fly-By-Wire, oscillations suppression, PIO
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