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Performance Investigation of Unmanned Aerial Vehicles Attitude Control Based on Modified PI-D and Nonlinear Dynamic Inversion

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Abstract : Interest in autopilot design has been raised intensely as a result of recent advancements in Unmanned Aerial vehicles (UAVs). Due to the enormous number of applications that UAVs can achieve, the number of applied control theories used for them has increased in recent years. These small fixed-wing UAVs are suffering high non-linearity, sensitivity to disturbances, and coupling effects between their channels. In this work, the nonlinear dynamic inversion (NDI) control law is designed for a nonlinear small fixed-wing UAV model. The NDI is preferable for varied operating conditions, there is no need for a scheduling controller. Moreover, it's applicable for high angles of attack. For the designed flight controller validation, a nonlinear Modified PI-D controller is performed with our model. A comparative study between both controllers is achieved to evaluate the NDI performance. Simulation results and analysis are proposed to illustrate the effectiveness of the designed controller based on NDI.

Keywords : attitude control, nonlinear PID, dynamic inversion
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