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MULTICRITERIA ANALYSIS OF AN L_1 ADAPTIVE FLIGHT CONTROL SYSTEM

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Keywords	$\mathcal{L}_1$ adaptive control, flying qualities, multi-criteria optimization, Pareto space, randomized algorithms.
Abstract	This paper presents an overview of the application of the Parameter Space Investigation method for the multi-criteria design optimization of the $\mathcal{L}_1$ adaptive flight control system implemented on the two turbine-powered dynamically-scaled GTM AirSTAR aircraft. In particular, the study addresses the improvement of a nominal *prototype* solution, obtained using basic design guidelines of $\mathcal{L}_1$ adaptive control theory. The results validate the theoretical claims of $\mathcal{L}_1$ adaptive control in terms of closed-loop performance and robustness, and illustrate the systematic character of its design procedure. Furthermore, the paper shows the suitability of the Parameter Space Investigation method for the multi-criteria design optimization over a multi-dimensional design variable space of a flight control system subject to desired control specifications. The use of this particular method is of special interest, as it provides invaluable information about the behavior of the closed-loop system in an extended space of design parameters and performance criteria. The results and conclusions of this paper have led to a deeper understanding of the characteristics of the closed-loop adaptive system, and have contributed to the improvement of the flying qualities and the robustness margins of the adaptive $\mathcal{L}_1$-augmented aircraft, which has been recently flight tested by NASA.
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