# Reference Number JSCE1691

Dear Editor,

Once again, on behalf of my colleagues I would like to thank you and the reviewers for the time they devoted to reading the manuscript and pointing out issues that needed clarification.

In response to your and their comments we have

shortened the proofs in the appendix and now each proof fits in one page. The current appendix includes four pages of derivations (rather than eight) and represents 15% of the manuscript (rather than 25%). We have also removed some of the equations in the main body, shortening the revised manuscript by one additional page. As a result, the manuscript is now 27 pages long (rather than 32), and has a total of 59 numbered equations (rather than 81).

It is our opinion that further cuts, either in the main body or in the appendices, would compromise the rigor and clarity of the exposition. In fact, the current proofs in the manuscript are already hard to follow, as many technical details are now missing. While we agree that experimentation is crucial to validate the developed algorithms, we also think that theoretical derivations are critical to understand both their advantages and limitations.

In what follows we attach our response to each of the reviewers. Thank you for your consideration of our work.

Sincerely,

Vladimir Dobrokhodov

# Response to the first reviewer

1. *The authors should give the control schemes and Matlab design diagrams in "IV. Solutions and Analysis".*
2. *In 21 papers of "Bibliography", there are 7 papers written by the authors of Dr. Hovakimyan and Dr. Cao even though they have been focusing on the development and the application of L1 adaptive control for many years.*

# Response to the third reviewer

1. *This paper addresses an important aspect of adaptive control using L1 criterion and applies the results to a real world problem at NASA.*

# Response to the forth reviewer

1. *This paper mainly focused on the application of the Parameter Space Investigation method for the multi-criteria design optimization of the L1 adaptive flight control system implemented on the two turbine powered dynamically-scaled GTM AirSTAR aircraft, experimental results are also given.*
2. *I believe the contents are not new, the innovative contents are not highlighted. The authors failed to compare the presented method with other current methods, and the feasibility and effectiveness, especially the advantages of the presented approach are not verified.*

# Response to the fifth reviewer

1. *My largest concern is that the response of the prototype (shown page 8) and case #202 (page 25) to a 3deg change in AoA for 4 seconds appears to be divergent if held longer than 4 sec. This might be due to changes in flight condition of an increase in climb angle. Would this occur on a linearization of the system? Include an analysis of what is happening and why we should not be concerned.*
2. *On page 6, the longitudinal system is described as SISO, that uses AoA and pitch rate feedback. I understand the single output is intended to be the control variable AoA, but the system has two outputs being used in the control.*
3. *For P12 (page 13), it is unclear if the max includes the entire equation of just the delta e term. Although in P13 it is expressed more clearly that it should include the entire equation.*

RE: The equation defining the maximum deviation in cross-coupling dynamics is revised and presented in the following unambiguous form;



1. *On page 15, 'a priory' should read 'a priori'.*

RE: corrected

1. *On page 17, 'useful inside' should read 'useful insight'.*

RE: corrected

1. *On page 24, the statement is made that smaller damping ratio results in reduced pilot compensation, but Figure 7 appears to show the opposite.*

RE: In the revised version it is clarified that the flight qualities criteria *FQ1*(*FQ2*) is analyzed versus the design variable *DV2* corresponding to the damping ratio of the state predictor. As it follows from the definition of both criteria given on page 14, the objective of the optimization consists in minimizing the criteria. The revised conclusion is presented as follows:

While in the first PSI iteration the dependency of the criterion *FQ2* on the design variable *DV2* was not obvious, now it is clear that reducing the *DV2* from 0.85 of the prototype design to about 0.75 of optimal solutions reduces the tracking error captured by the criterion *FQ1* (similarly for the pilot workload - *FQ2*) by about 20%. Thus, it becomes apparent that a smaller damping ratio of the state predictor results in reduced (lead) pilot compensation.

# References

# List of key changes