Comments for author and editor \*

The paper “Extended optimization study and panel parameter study for noise radiation reduction of an aircraft panel excited by turbulent flow” by Steven A. J. Sonnenberg and Joana Rocha presents a study with the objective to reduce the acceleration PSD of a panel excited by a TBL. It was shown that an optimum panel length for minimum acceleration ASD can be found using the presented optimization technique.

Below please find some suggestions for the French writing in the paper.

Résumé

Le bruit et les vibrations dans une cabine d'aéronef en conditions de croisière sont principalement causés par des excitations extérieures d’écoulement d’air de la Couche Limite Turbulente (CLT). La CLT provoque des vibrations sur les panneaux de fuselage de l’aéronef. Ces vibrations rayonnent de l'énergie sonore sous la forme de bruit. Par conséquent, il est intéressant de déterminer quel paramètre du panneau d’aéronef est le plus susceptible de diminuer la quantité d'énergie acoustique rayonnée afin de permettre l'optimisation de ces paramètres pour réduire le bruit dans la cabine. Un modèle analytique a été créé et validé à l'aide de Matlab pour calculer la Densité Spectrale de Puissance (DSP) de l’accélération, qui est proportionnelle à la Puissance Acoustique Rayonnée (PAR). Une étude de sensibilité paramétrique a été réalisée, afin de déterminer la variation de la DSP de l’accélération, en relation aux sept différents paramètres du panneau: épaisseur du panneau, la densité du matériau, la largeur et la longueur du panneau, le module d'élasticité, le coefficient de Poisson, et le coefficient d'amortissement. Une méthode analytique pour optimiser la performance acoustique d’un panneau d'aéronef est présentée, en changeant les propriétés du panneau, afin de réduire la DSP de l’accélération du panneau provoquée par la CLT. Il est montré que l'épaisseur et la densité du panneau sont les paramètres les plus cohérents et les plus susceptibles de réduire la DSP de l’accélération, dans différentes bandes d'octave dans la gamme des fréquences audibles.

Mots-clés: Optimisation, Réduction du bruit, Puissance Acoustique Rayonnée, Couche Limite Turbulente, Acoustique structurelle

Author Comment: Corrected

As expected the panel thickness and the panel density are the most consistent, and effective parameters at reducing the acceleration PSD at different octave bands in the human hearing range.

Author Comment: Corrected

The optimization problem consisted in separately adjusting the geometric and elastic properties of the panels, in order to achieve minimum acceleration PDS. While geometric properties are unrelated the ones to the others, the elastic properties are intrinsic to existing materials and a material with optimum properties obtained separately: density, Young’s modulus, Poisson’s ratio, damping coefficient, would not result in a realistic solution. Moreover it is not clear from the text of the paper if when one of the variables is optimized the others are kept at their initial values.

Author Comment:

Introduction had stated:

“For this initial study there are no constraints being used. However, in future studies these will be the physical constraints of actual materials available for the construction of the panels.”

Corrected too:

“For this initial study there are no constraints being used in order to determine general trends when optimizing the seven parameters. However, in future studies these will be the physical constraints of actual materials available for the construction of the panels. These constraints could be considered in future work, for a second phase of the research, since the panel elastic properties are intrinsic to existing materials, and a material with optimum properties obtained independently (i.e. density, elasticity modulus, Poisson’s ratio, or damping coefficient) would not result in a realistic solution.”

Results had stated:

“The parameters were varied individually while maintaining the other variables at their initial values, and the changes in the acceleration PSD in each of the octave bands were analyzed.”

Corrected too:

“The parameters were varied individually while maintaining the other variables at their initial values, and the changes in the acceleration PSD in each of the octave bands were analyzed. In the present study, no constraints have been considered (one parameter relative to another), in order to determine the general trends when optimizing each of the seven individual parameters. Future work could consider these constraints.”

The authors have to provide as a minimum the starting parameters of the optimization problem: panel dimensions, thickness and the material properties.

Author Comment: Corrected with Table 1

The figure legends have to be improved. For instance, as the markers are missing in the legend, it is very hard to make a clear correspondence between the legend content and the plot lines. It is not clear which line is associated to optimization results for Damping and which is for the Thickness. Same comment for plots of optimization results according to the Panel Width and the Poisson’s ratio.

Author Comment: Corrected on Figure 1 to Figure 4

Equation on line 167 should be written: M=Mx\*My.

Author Comment: Corrected

Please indicate that dispersion equation Eq 9 applies to pressurized fuselage. If it is not used here why is it mentioned in the article? From a simple plate dispersion equation perspective, Eq 10 is the most used in literature.

Author Comment:

Methodology had stated:

“This equation can be simplified to assume that the panel is not under tension in either direction, which is the same assumption used for the validation case, in this study.”

Corrected too:

“The dispersion equation (9) applies to a pressurized fuselage which will be analyzed in the future however, this equation can be simplified to assume that the panel is not under tension in either direction, which is the same assumption used for the validation case, in this study.”

Equation (14) needs to be corrected.

Author Comment: Corrected

Please define M(omega) in Eq 29.

Author Comment: Corrected

On line 288 it is asserted that the low observed correlation is probably due to the low number of modes considered in the study. Would a higher number of modes have had improve the correlation or the low modal density of the plate is also a factor?

Author Comment:

Results had stated:

“This could be due to the low number of panel modes used at low frequencies. According to the convergence test, as the target frequency decreases, there becomes less panel modes required.”

Corrected too:

“This could be due to the low number of panel modes existent at low frequencies. This can be seen as well from the convergence criteria [10], when one observes that decreasing the frequency, less panel modes are required to achieve convergence.”

Please provide the results in Figure 6 for the full frequency range 0-2200Hz or provide a reason for the chosen 200-700Hz frequency range.

Author Comment: Corrected

I have added Figure 7 to the paper along with additional explanation of the findings in these higher frequency ranges.

The authors have used in this paper a lot of previous work published by Prof. Rocha and they should try to better emphasize the real originality of the present work. Moreover it should be better emphasized in the paper the technical and scientific benefits and importance of the findings presented in the paper.

Author Comment:

Introduction has been modified to:

“In the present work, an analytical model which calculates the acceleration PSD was developed in Matlab, based on previously developed models by the author [1,8,9,10,11]. The current study adds a step forward on previous analyzes by the author, by focusing on the use of these models to determine the effects of modifying aircraft panels’ properties on the panel acceleration. In addition, an analytical optimization has been applied in order to determine the panel properties to which will result in higher panel acceleration PSD reduction caused by the TBL.”

Conclusion has been modified to:

“The optimization model described in the current paper will be useful in the earlier stages of aircraft design, by helping the designer to select panel configurations that reduce the amount of noise due to the TBL inside the cabin of the aircraft.”