Document details

‹ Back to results | 1 of 10 Next ›

Export Download Print E-mail Save to PDF Add to List More... ›

Full Text View at Publisher

CFD Letters Open Access
Volume 12, Issue 4, 2020, Pages 79-89

Gust load alleviation of flexible composite wing (Article) (Open Access)

Ibren, M.[a], Sulaeman, E.[a], Andan, A.D.[a], Aminanda, Y.[b], Halim, A.K.A.[a,c]

[a]Department of Mechanical Engineering, Faculty of Engineering, International Islamic University Malaysia, Kuala Lumpur, 53100, Malaysia
[b]Department of Mechanical Engineering, Faculty of Engineering, Universiti Teknologi Brunei, BE1410, Brunei Darussalam
[c]Department of Aeronautical Engineering, Faculty of Mechanical and Manufacturing Engineering, Universiti Tun Hussein Onn Malaysia, Johor 86400, Malaysia

Abstract

View references (18)

Gust load due to atmospheric turbulence is mandatory to be considered in aircraft analysis as part of airworthiness requirement. This safety related issue becomes more relevant recently in relation to the global warming that induces more frequent and extreme atmospheric disturbances encountered during air transportation. A direct application of gust load on the wing structural analysis, however, is not recommended since it will result in a significant weight increase due to the overdesign of the wing structure. At this point, the gust load alleviation plays an important role to effectively utilize the wing structural flexibility without ignoring the safety issue. In the present work, a method to alleviate the wing gust load is proposed by considering different configurations of the wing planform, wing sweep angle, wing dihedral angle and composite material layers. The objective of the study is to minimize the wing root bending moment due to the gust . The gust load analysis of the Kim-Hwang's wing model will be used and the results are compared to the literature for the validation purpose. A finite element approach is used to simulate the wing structure in combination with the doublet lattice method to model the wing aerodynamics. It is found that the wing dihedral angle plays insignificant changes to the wing root bending moment due to the gust load . The wing sweep angle, however, gives significant changes to the wing root bending moment. For the present configuration, the optimum swept back configuration with a 45° sweep angle and optimum composite lay-up showed an average decrease of the bending moment by 12% for frequency range of 0 to 100 Hz. © 2020 PENERBIT AKADEMIA BARU.

SciVal Topic Prominence

Topic: Slende Wing | Gust Load | Flutter

Prominence percentile: 87.330

Author keywords

Aeroelasticity | Composite flexible wing | Dynamic response | Fluid-structure interaction | Gust load

Funding details

Funding sponsor	Funding number	Acronym
International Islamic University Malaysia	FRGS17-036-0602	IIUM

Funding text

The support of Malaysian Ministry of Higher Education through International Islamic University Malaysia under the research grant FRGS17-036-0602 is gratefully acknowledged. The authors would like to thank STRIDE to give permission to use NASTRAN in their facility.

ISSN: 21801363
DOI: 10.37934/cfdl.12.4.7989
Source Type: Journal
Document Type: Article
Original language: English
Publisher: Penerbit Akademia Baru

References (18)

View in search results format >

All | Export | Print | E-mail | Save to PDF | Create bibliography

1 Cook, R.G., Palacios, R., Goulart, P.
Robust gust alleviation and stabilization of very flexible aircraft

(2013) *AIAA Journal*, 51 (2), pp. 330-340. Cited 74 times.
http://arc.aiaa.org/doi/pdfplus/10.2514/1.J051697
doi: 10.2514/1.J051697

View at Publisher

2 Dillsaver, M.J., Cesnik, C.E.S., Kolmanovsky, I.V.
Gust response sensitivity characteristics of very flexible aircraft

(2012) *AIAA Atmospheric Flight Mechanics Conference 2012*. Cited 19 times.
http://arc.aiaa.org/doi/pdf/10.2514/6.2012-4576
ISBN: 978-162410184-7
doi: 10.2514/6.2012-4576

View at Publisher

3 Weisshaar, T.
Static aeroelastic behavior of an adaptive laminated piezoelectric composite wing
(1990) *31St Structures, Structural Dynamics and Materials Conference*, p. 1078.
https://doi.org/10.2514/6.1990-1078

4 Gauthier-Perron, S., Drelay, M.
SDM 2013 student papers competition passive gust load alleviation through bend-twist coupling of composite beams on typica

(2013) *54th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference*. Cited 4 times.
http://arc.aiaa.org/doi/pdf/10.2514/6.2013-1490
ISBN: 978-162410223-3
doi: 10.2514/6.2013-1490

View at Publisher

5 Guo, S., Li, D., Liu, Y.
Multi-objective optimization of a composite wing subject to strength and aeroelastic constraints

(2012) *Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering*, 226 (9), pp. 1095-1106. Cited 35 times.
doi: 10.1177/0954410011417789

View at Publisher

6 Guo, S., De Los Monteros, J.E., Liu, Y.
Gust alleviation of a large aircraft with a passive twist wingtip (Open Access)

(2015) *Aerospace*, 2 (2), pp. 135-154. Cited 18 times.
http://www.mdpi.com/2226-4310/2/2/135/pdf
doi: 10.3390/aerospace2020135

View at Publisher

7 Hoblit, F.M.
(2012) *Gust Loads on Aircraft: Concepts and Applications*. Cited 380 times.
AIAA Education Series
https://doi.org/10.2514/4.861888

8 Kim, T.-U., Hwang, I.H.
Optimal design of composite wing subjected to gust loads
(2005) *Computers and Structures*, 83 (19-20), pp. 1546-1554. Cited 56 times.
doi: 10.1016/j.compstruc.2005.02.002
View at Publisher

9 McLean, D.
GUST-ALLEVIATION CONTROL SYSTEMS FOR AIRCRAFT.
(1978) *Proceedings of the Institution of Electrical Engineers*, 125 (7), pp. 675-685. Cited 29 times.
doi: 10.1049/piee.1978.0159
View at Publisher

10 (1970) *Part 25-Airworthiness Standards: Transport Category Airplanes*. Cited 64 times.
Federal Aviation Administration (FAA), USA

11 Rodden, W.P., Johnson, E.H.
(1994) *MSC/NASTRAN Aeroelastic Analysis: User's Guide*. Cited 403 times.
Version 68. MacNeal-Schwendler Corporation

12 Su, W., Cesnik, C.E.S.
Dynamic response of highly flexible flying wings
(2011) *AIAA Journal*, 49 (2), pp. 324-339. Cited 120 times.
http://pdf.aiaa.org/getfile.cfm?
urlX=%2D%3CWI%277D%2FQKS%2B%2ER%40WHWP%20%20%0A&urla=%26%2A%22L%20%23%20%2AC%0A&urlb=%21%2A%20%20%20%0A&urlc=%
doi: 10.2514/1.J050496
View at Publisher

13 (1976) *National Oceanic and Atmospheric Administration*. Cited 69 times.
National Aeronautics and Space Administration, United States Air Force, Washington, DC

14 Lin, C.Y., Crawley, E.F., Heeg, J.
Open- and closed-loop results of a strain-actuated active aeroelastic wing
(1996) *Journal of Aircraft*, 33 (5), pp. 987-994. Cited 59 times.
http://arc.aiaa.org/loi/ja
doi: 10.2514/3.47045
View at Publisher

15 Wright, J.R., Cooper, J.E.
Introduction to Aircraft Aeroelasticity and Loads: Second Edition (Open Access)
(2015) *Introduction to Aircraft Aeroelasticity and Loads: Second Edition*, pp. 1-543. Cited 330 times.
http://onlinelibrary.wiley.com/book/10.1002/9781118700440
ISBN: 978-111870044-0; 978-111848801-0
doi: 10.1002/9781118700440
View at Publisher

16 Yu, Y., Wang, Z., Guo, S.
Efficient method for aeroelastic tailoring of composite wing to minimize gust response
(2017) *International Journal of Aerospace Engineering*, 2017, pp. 1-12.
https://doi.org/10.1155/2017/159

17 Tajuddin, N., Mat, S., Said, M., Mansor, S.
Flow characteristic of blunt- edged delta wing at high angle of attack
(2017) *Journal of Advanced Research in Fluid Mechanics and Thermal Sciences*, 39 (1), pp. 17-25. Cited 15 times.
http://www.akademiabaru.com/doc/ARFMTSV39_N1_P17_25.pdf

18 Munshi, A., Sulaeman, E., Omar, N., Ali, M.Y.
CFD analysis on the effect of winglet cant angle on aerodynamics of ONERA M6 wing
(2018) *Journal of Advanced Research in Fluid Mechanics and Thermal Sciences*, 45 (1), pp. 44-54. Cited 5 times.
http://www.akademiabaru.com/doc/ARFMTSV45_N1_P44_54.pdf

Sulaeman, E.; Department of Mechanical Engineering, Faculty of Engineering, International Islamic University Malaysia, Kuala Lumpur, Malaysia; email:esulaeman@iium.edu.my

Back to results | 1 of 10 Next

Top of page

About Scopus
What is Scopus
Content coverage
Scopus blog
Scopus API
Privacy matters

Language
日本語に切り替える
切换到简体中文
切換到繁體中文
Русский язык

Customer Service
Help
Contact us