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NUMERICAL MODELLING OF BIRD STRIKE ON A ROTATING ENGINE BLADES BASED ON VARIATIONS OF POROSITY DENSITY

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Numerical Investigation on the Damage of Whirling Engine Blades Subjected to Bird Strike Impact

Shahimi, S.-S. , Abdullah, N.A. , Hrairi, M. (2021) *Journal of Aeronautics, Astronautics and Aviation*

Numerical Simulation of Bird Impact on Hollow Blades of Titanium Fan Assembly

Hou, N. , Li, Y. , Liu, J. (2019) *Journal of Aerospace Engineering*

Computational and experimental study of bird failure at different speeds of collision with a flexible plate

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A numerical investigation is conducted on a rotating engine blade subjected to a bird strike impact. The bird strike is numerically modelled as a cylindrical gelatine with hemispherical ends to simulate impact on a rotating engine blade. Numerical modelling of a rotating engine blade has shown that bird strikes can severely damage an engine blade, especially as the engine blade rotates, as the rotation causes initial stresses on the root of the engine blade. This paper presents a numerical modelling of the engine blades subjected to bird strike with porosity implemented on the engine blades to investigate further damage assessment due to this porosity effect. As porosity influences the decibel levels on a propeller blade or engine blade, the damage due to bird strikes can investigate the compromise this effect has on the structural integrity of the engine blades. This paper utilizes a bird strike simulation through an LS-Dyna Pre-post software. The numerical constitutive relations are keyed into the keyword manager where the bird's SPH density, a 10 ms simulation time, and bird velocity of 100 m/s are all set. The blade rotates counter-clockwise at 200 rad/s with a tetrahedron mesh. The porous regions or voids along the blade are featured as 5 mm diameter voids, each spaced 5 mm apart. The bird is modelled as an Elastic-Plastic-Hydrodynamic material model to analyze the bird's fluid behavior through a polynomial equation of state. To simulate the fluid structure interaction, the blade is modelled with Johnson-Cook Material model parameters of aluminium where the damage of the impact can be observed. The observations presented are compared to previous study of a bird strike impact on non-porous engine blades. © 2022. IIUM Engineering Journal. All Rights Reserved.

Author keywords

Bird strike ; Porosity ; Rotating engine blades ; Sph; Structural damage

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1

Thorpe, J.

100 years of fatalities and destroyed civil aircraft due to bird strikes (2012) *30th Meeting of the International Bird Strike Committee*, pp. 1-36. Cited 18 times.

[1]

- 2 Wilbeck, J.S., Rand, J.L.
The development of a substitute bird model

(1981) *Journal of Engineering for Gas Turbines and Power*, 103 (4), pp. 725-730. Cited 85 times.
doi: 10.1115/1.3230795

View at Publisher
-
- 3 Liu, J., Li, Y., Gao, X.
Bird strike on a flat plate: Experiments and numerical simulations

(2014) *International Journal of Impact Engineering*, 70, pp. 21-37. Cited 59 times.
doi: 10.1016/j.ijimpeng.2014.03.006

View at Publisher
-
- 4 Guan, Y., Zhao, Z., Chen, W., Gao, D.
Foreign object damage to fan rotor blades of aeroengine part II: Numerical simulation of bird impact ([Open Access](#))

(2008) *Chinese Journal of Aeronautics*, 21 (4), pp. 328-334. Cited 32 times.
<http://www.sciencedirect.com/science/journal/10009361>
doi: 10.1016/S1000-9361(08)60043-6

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-
- 5 Abdullah, N.A., Akbar, M., Wirawan, N., Curiel-Sosa, J.L.
Structural integrity assessment on cracked composites interaction with aeroelastic constraint by means of XFEM ([Open Access](#))

(2019) *Composite Structures*, 229, art. no. 111414. Cited 9 times.
www.elsevier.com/inca/publications/store/4/0/5/9/2/8
doi: 10.1016/j.compstruct.2019.111414

View at Publisher
-
- 6 Wirawan, N., Abdullah, N.A., Akbar, M., Curiel-Sosa, J.L.
Analysis on Cracked Commuter Aircraft Wing under Dynamic Cruise Load by Means of XFEM ([Open Access](#))

(2018) *Journal of Physics: Conference Series*, 1106 (1), art. no. 012014. Cited 2 times.
<http://iopscience.iop.org/journal/1742-6596>
doi: 10.1088/1742-6596/1106/1/012014

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-
- 7 Ahmad, M.I.M., Curiel-Sosa, J.L., Akbar, M., Abdullah, N.A.
Numerical Inspection based on Quasi-Static Analysis using Rousselier Damage Model for Aluminium Wingbox Aircraft Structure ([Open Access](#))

(2018) *Journal of Physics: Conference Series*, 1106 (1), art. no. 012013. Cited 3 times.
<http://iopscience.iop.org/journal/1742-6596>
doi: 10.1088/1742-6596/1106/1/012013

View at Publisher

- 8 Shahimi, S.-S., Abdullah, N.A., Hrairi, M., Ahmad, M.I.M.
Numerical Investigation on the Damage of Whirling Engine Blades Subjected to Bird Strike Impact

(2021) *Journal of Aeronautics, Astronautics and Aviation*, 53 (2), pp. 193-199. Cited 3 times.
<http://www.aasrc.org.tw/>
doi: 10.6125/JoAAA.202106_53(2).11

View at Publisher
-
- 9 Vignjevic, R., Orłowski, M., De Vuyst, T., Campbell, J.C.
A parametric study of bird strike on engine blades

(2013) *International Journal of Impact Engineering*, 60, pp. 44-57. Cited 48 times.
doi: 10.1016/j.ijimpeng.2013.04.003

View at Publisher
-
- 10 Aldheeb, M., Asrar, W., Sulaeman, E., Omar, A.A.
Aerodynamics of porous airfoils and wings (Open Access)

(2018) *Acta Mechanica*, 229 (9), pp. 3915-3933. Cited 10 times.
<http://www.springerlink.com/content/0001-5970>
doi: 10.1007/s00707-018-2203-6

View at Publisher
-
- 11 Kovalev, IS.
Buttefly acoustical skin - new method of reducing aero acoustical noise for a quiet propeller
(2019) *J. Engineering Mechanics and Machinery*, 4 (1), pp. 1-28.
[11]
-
- 12 Dar, U.A., Awais, M., Mian, H.H., Sheikh, M.Z.
The effect of representative bird model and its impact direction on crashworthiness of aircraft windshield and canopy structure

(2019) *Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering*, 233 (14), pp. 5150-5163. Cited 9 times.
<http://pig.sagepub.com/content/by/year>
doi: 10.1177/0954410019837857

View at Publisher
-
- 13 Riccio, A., Cristiano, R., Saputo, S.
A brief introduction to the bird strike numerical simulation (Open Access)

(2016) *American Journal of Engineering and Applied Sciences*, 9 (4), pp. 946-950. Cited 7 times.
<http://thescipub.com/pdf/10.3844/ajeassp.2016.946.950>
doi: 10.3844/ajeassp.2016.946.950

View at Publisher
-

- 14 Banerjee, A., Dhar, S., Acharyya, S., Datta, D., Nayak, N.
Determination of Johnson cook material and failure model constants and numerical modelling of Charpy impact test of armour steel

(2015) *Materials Science and Engineering A*, 640, pp. 200-209. Cited 106 times.

<http://www.elsevier.com>

doi: 10.1016/j.msea.2015.05.073

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