## Documents

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**Detecting Problematic Vibration on Unmanned Aerial Vehicles via Genetic-Algorithm Methods**
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**Abstract**
Unmanned Aerial Vehicles (UAV) problematic vibration detection as a flaw detection and identification (FDI) method has emerged as a feasible tool for assessing a UAV's health and condition. This paper shows the potential of optimization-based UAV problematic vibration detection. A proposed fitness function based on the frequency domain has been detailed. The fitness function with the Genetic Algorithm (GA) optimization method is tested and evaluated based on Root Mean Squared Error (RMSE), Mean Absolute Percentage Error (MAPE), and detection time. 51 sets of data have been collected using software in the loop (SITL) methods and are used to determine the effectiveness of the proposed fitness function and GA. The test results show promising results with obtained mean RMSE =1407.2303, mean MAPE =0.7135, and mean detection time =2.6129s for a data range of between 3955 to 9057. © 2024 IEEE.

**Author Keywords**
Frequency-Domain; Genetic Algorithm; Mean Absolute Percentage Error; Problematic Vibration; Root Mean Square Error

**Index Keywords**
Aircraft detection, Antennas, Frequency domain analysis, Mean square error, Unmanned aerial vehicles (UAV), Vibrations (mechanical); Aerial vehicle, Detection time, Fitness functions, Frequency domains, Mean absolute percentage error, Percentage error, Problematic vibration, Root mean square errors, Root mean squared errors, Vibration detection; Genetic algorithms

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**References**

- Weiqi, Y., Hui, Y., Shuo, T.
  **Optimization and control application of sensor placement in aeroservoelastic of UAV**
  (2019) *Aerospace Science and Technology*, 85, pp. 61-74.
- Songhe, Y., Kaoru, O., Mianxiong, D., Jianghai, Z.
  **A Path Planning Method with Perception Optimization Based on Sky Scanning for UAVs**
  (2022) *Sensors*, 22 (3).
  2022
- Al-Mashhadani, M.A.
  **Optimal control and state estimation for the unmanned aerial vehicle under random vibration and uncertainty**
  (2019) *Measurement and Control*, 52 (9-10).
- Ghazali, M.H.M., Rahiman, W.
  **Vibration-Based Fault Detection in Drone Using Artificial Intelligence**
  (2022) *IEEE Sensors Journal*, 22 (9), pp. 8439-8448.
  1 May

- Kai, Z., Zequn, W., Yi-Qing, N., Yang, Z., Jiong, T.
**Unmanned aerial vehicle-based computer vision for structural vibration measurement and condition assessment: A concise survey**
(2023) *Journal of Infrastructure Intelligence and Resilience*, 2.

- Gongfa, C., Shuai, T., Fangsen, C.
**A Bridge Vibration Measurement Method by UAVs based on CNNs and Bayesian Optimization**
(2023) *Journal of Applied and Computational Mechanics*, 9 (3), pp. 1-14.

- Abbaspour, A., Yen, K.K., Noei, S., Sargolzaei, A.
**Detection of Fault Data Injection Attack on UAV Using Adaptive Neural Network**
(2016) *Procedia Comput. Sci*, (95), pp. 193-200.

- Fan, H., Fang, H., Dong, Y., Shi, H., Ren, S.
**UAV engine fault and diagnosis with parameter models based on telemetry data**
(2017) *Prognostics and System Health Management Conference (PHMHarbin)*, pp. 1-6.

- Saied, M., Tabikh, A.R., Francis, C., Hamadi, H., Lussier, B.
**An Informational Approach for Fault Tolerant Data Fusion Applied to a UAV's Attitude, Altitude, and Position Estimation**
(2021) *IEEE Sens. J*, (21), pp. 27766-27778.

- Charles Preston, J.
(2018) *DEVELOPMENT OF A SOFTWARE IN THE LOOP SIMULATION APPROACH FOR RISK MITIGATION IN UNMANNED AERIAL SYSTEM DEVELOPMENT*,
Bachelor of Science in Mechanical Engineering, Mechanical and Aerospace Engineering, Oklahoma State University, Stillwater, Oklahoma

- Soh, S.C., Ibrahim, M.Z., Abas, M.F., Sulaiman, N., Mulvaney, D.J.
**Image Fusion based Multi Resolution and Frequency Partition Discrete Cosine Transform for Palm Vein Recognition**
(2019) *IEEE 6th International Conference on Industrial Engineering and Applications (ICIEA)*, pp. 367-371.

- Aziz, M.A.A., Abas, M.F., Ali, M.A.H., Saad, N.M., Ariff, M.H.M., Bashrin, M.K.A.A.
**Estimating the Un-sampled pH Value via Neighbouring Points Using Multi-Layer Neural Network-Genetic Algorithm**
(2023) *2023 19th IEEE International Colloquium on Signal Processing & Its Applications (CSPA)*, pp. 207-212.



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