JEEE-U (Journal of Electrical and Electronic Engineering-UMSIDA)
Vol 5 No 1 (2021): April, 103-115
Electrical Power Engineering

The Effects of Damage to the Outer Race Bearing on the Efficiency of the Induction Motor Using Fast Fourier Transform (FFT) Method

Efek Kerusakan Outer Race Bearing Terhadap Efisiensi Motor Induksi Menggunakan Metode Fast Fourier Transform (FFT)

Sulaiman Isfar — Hang Tuah University, Surabaya
Iradiratu Diah Prahmana Karyatanti — Hang Tuah University, Surabaya
Belly Yan Dewantara — Hang Tuah University, Surabaya

Bearing is an induction motor component that helps the rotor to move freely, in industrial applications it is important to maintain bearing performance in induction motors. In its use, bearing damage is one of the biggest types of damage that is often found in induction motors. Bearing damage can lead to increased vibration, increased noise, increased working temperature, and decreased efficiency. Efficiency reduction can be used as information on the condition of the motor so that this information can be used to detect damage before more serious damage occurs. This research discusses the stator current analysis method and the efficiency of damage to the motor through two harmonic amplitude ratios equipped with the fast Fourier transform (FFT) algorithm in detecting damage to the outer race bearing. It is hoped that this efficiency can be used as an evaluation of the extent to which motor energy waste occurs before more severe damage. The efficiency results on the damage to the outer race bearing using the FFT method get the highest efficiency value of 1.47 and the lowest value of 0.66.

References

1. Asfani, D. A., Soedibyo, S., Negara, I. M. Y., Fahmi, D., Septiawan, M. E., Wahyudi, M., & Rifma, N. I. (2017). Design of Motor Current Signature Analyses (MCSA) Based on LabVIEW for Online Detection of Induction Motor Faults. JAREE (Journal on Advanced Research in Electrical Engineering), 1(2), 27–34. https://doi.org/10.12962/j25796216.v1.i2.20.
2. Constantin, A. I., & Fireţeanu, V. (2015). Efficiency in the detection of three important faults in induction motors through external magnetic field. 2015 9th International Symposium on Advanced Topics in Electrical Engineering, ATEE 2015, 430–435. https://doi.org/10.1109/ATEE.2015.7133843
3. DPK, I., Dewantara, B. Y., & Janudin, A. M. (2019). Deteksi Kerusakan Inner Race Bearing Menggunakan Motor Current Signature Analysis Berbasis Fast Fourier Transform. Jurnal Teknik Elektro Dan Komputer TRIAC, 6(1), 24–25. https://doi.org/10.21107/triac.v6i1.5145.
4. Fireteanu, V., Leconte, V., & Constantin, A. I. (2015). Influence of the magnetic steel frame on the efficiency of short-circuit faults detection in induction motors through harmonics of the neighboring magnetic field. 2015 9th International Symposium on Advanced Topics in Electrical Engineering, ATEE 2015, 398–403. https://doi.org/10.1109/ATEE.2015.7133836 .
5. Frosini, L., & Bassi, E. (2010). Stator current and motor efficiency as indicators for different types of bearing faults in induction motors. IEEE Transactions on Industrial Electronics. https://doi.org/10.1109/TIE.2009.2026770.
6. Haddad, R. Z., Lopez, C. A., Pons-Llinares, J., Antonino-Daviu, J., & Strangas, E. G. (2015). Outer race bearing fault detection in induction machines using stator current signals. Proceeding - 2015 IEEE International Conference on Industrial Informatics, INDIN 2015, 801–808. https://doi.org/10.1109/INDIN.2015.7281839.

7. Iradiratu Diah, P. K., Dewantara, B. Y., Abduh, M., Sudirman, & Utomo, W. M. (2019). Healthy monitoring and fault detection outer race bearing in induction motor using stator current. International Journal of Integrated Engineering, 11(3), 181–193. https://doi.org/10.30880/ijie.2019.11.03.019.
8. Leggate, D., Pankau, J., Schlegel, D. W., Kerkman, R. J., & Skibinski, G. L. (1999). Reflected waves and their associated current. IEEE Transactions on Industry Applications. https://doi.org/10.1109/ias.1998.732416.
9. Septianto, F., Widodo, A., Jurusan, M., Mesin, T., Teknik, F., Diponegoro, U.,Diponegoro, U. (2015). Online : http://ejournal-s1.undip.ac.id/index.php/jtm Online : http://ejournal-s1.undip.ac.id/index.php/jtm, 4(4), 397–407.
10. Thipsuwanporn, V., Numsamran, A., & Leawsoong, M. (2012). Balance weight fault detection in compressor using FFT algorithm. International Conference on Control, Automation and Systems, 798–802.