LIFE PREDICTION OF BEARING USING ACCELERATED LIFE TEST COUPLED WITH ANALYSIS

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The amount of wear is a significant factor for evaluating bearing failure. However, it is difficult to predict the precise occurrence of failure, because the wear gradually happens for a prolonged period. Therefore, it is impossible to assure the bearing life experimentally. In this study, the accelerated life testing coupled with numerical analysis was performed to predict the accurate bearing life. The process can be described as follows: first of all, material characteristics and wear coefficients were obtained through tensile test and constant wear test; second, acceleration factor of wear depth was calculated by looking different test conditions, such as load and rpm; third, test response prediction function was derived and product life prediction function was determined by the acceleration factor; Finally, wear depth was calculated by solving two functions above. Meanwhile, to verify the result of the accelerated life test, the rating life of ISO standard was compared. Life prediction of the bearing for spalling calculated by accelerated life test was compared with the standard bearing life. The results showed that the accelerated life test result and the standard bearing life were similar. In conclusion, the accelerated life test coupled with numerical analysis could be employed to predict the bearing life the more rapidly and more accurately in comparison to other traditional test methods.

REFERENCES

[1] Mettas, A. and P. Vassiliou., "Application of quantitative accelerated life models on load sharing redundancy", Reliability and Maintainability, 2004 Annual Symposium - RAMS. 2004.

[2] Srivastava, P.W. and N. Jain, "Optimum ramp-stress accelerated life test for m identical repairable systems", Applied Mathematical Modelling, 2011, Vol. 35, No.12, pp. 5786-5793

[3] Rajkumar, K., K. Kundu, S. Aravindan, and M.S. Kulkarni, "Accelerated wear testing for evaluating the life characteristics of copper–graphite tribological composite", Materials & Design. Vol. 32, No.5, pp. 3029-3035, (2011)

[4] Zhang, C., S. Wang, and G. Bai, "An accelerated life test model for solid lubricated bearings based on dependence analysis and proportional hazard effect", Acta Astronautica. Vol. 95, No.0, pp. 30-36, (2014)

[5] M.M. Maru, R.S. Castillo, L.R. Padovese, "Study of solid contamination in ball bearings through vibration and wear analyses", Tribology International 40 (2007) 433–440

[6] Tuncay Karacay , Nizami Akturk, "Experimental diagnostics of ball bearings using statistical and spectral methods", Tribology International 42 (2009) 836–843

[7] Gurson, A.L, "Continuum theory of ductile rupture by void nucleation and growth: Part1-Yield criteria and flow rules for porous ductile media", Journal of Engineering Materials and Technology, Volume 99 Ser H, Issue 1, January 1977, Pages 2-15

[8] Viggo Tvergaard, "Influence of voids on shear band instabilities under plane strain conditions", International Journal of Fracture, August 1981, Volume 17, Issue 4, pp 389-407

[9] da Silva Jr, C.R.Á. and G. Pintaude, "Uncertainty analysis on the wear coefficient of Archard model", Tribology International, Vol. 41, No.6, pp. 473-481, (2008)

[10] Ersoy-Nürnberg, K., G. Nürnberg, M. Golle, and H. Hoffmann, "Simulation of wear on sheet metal forming tools an energy approach", Wear, Vol. 265, No.11–12, pp. 1801-1807, (2008)

[11] Kim, M.S., Hong, K. J. and Choi, D. H, "Trust-region Managed Approximate Optimization with a Progressive Quadratic Response Surface Modeling".