Reliability Prediction and Maintenance Interval Planning

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ABSTRACT

In this article, reliability prediction and planning of maintenance intervals .

Keywords: Vibroacoustics, Reliability, Electrically, Pneumatically, Hydraulically, PSW , Automotive, Optimal, Systems, Processes, P Oisson, MTBF, MTTR, RAM .

The reliability function R (t, z) of electrical, pneumatic and hydraulic subsystems WM - using equation (1) is calculated as

$$\boldsymbol{R(t,z)} = \left(\exp\left(-\frac{t}{166}\right)^{2.4}\right)^{\exp(-1.078OPSK-0.954ENVCON)} \quad (2)$$

$$\boldsymbol{R(t,z)} = \left(\exp\left(-\frac{t}{78.47}\right)^{2.09}\right)^{\exp(-0.602ENVCON-0.472MECHV)} \quad (3)$$

$$\boldsymbol{R(t,z)} = \left(\exp\left(-\frac{t}{38.3}\right)^{1.71}\right)^{\exp(-1.216ENVCON-0.518MP-0.614MECHV)} \quad (4)$$

The reliability function R (t , z) of electrical, pneumatic and hydraulic subsystems WM - using equation (5) is calculated as [1]

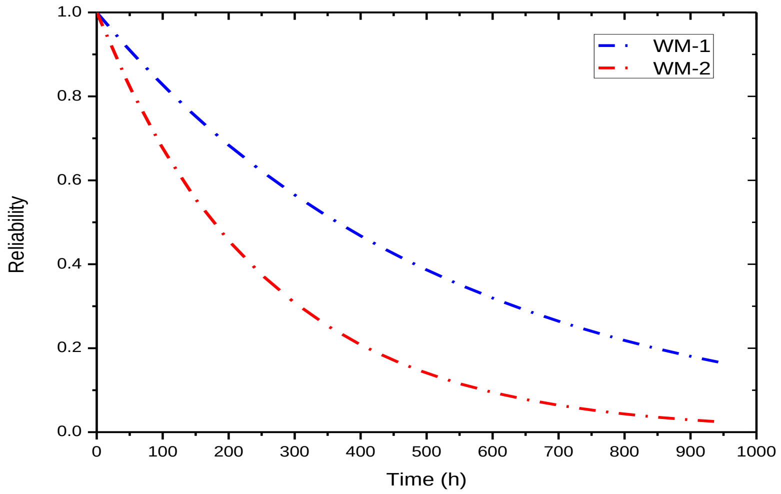

Figure 1: Comparison of reliability indicators of WM -I and WM electrical subsystems .

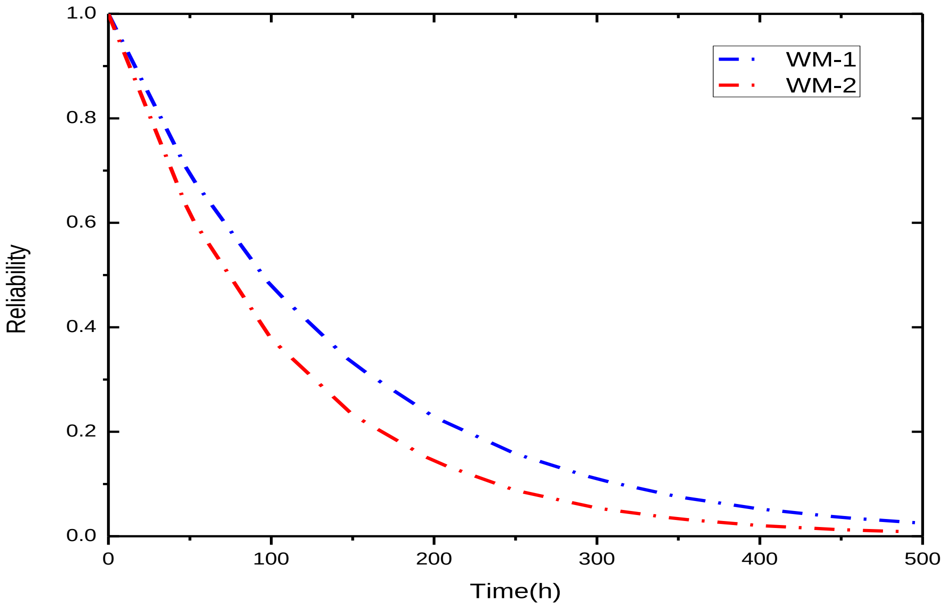

Figure 2: Comparison of reliability indices of WM -I and WM pneumatic subsystems .

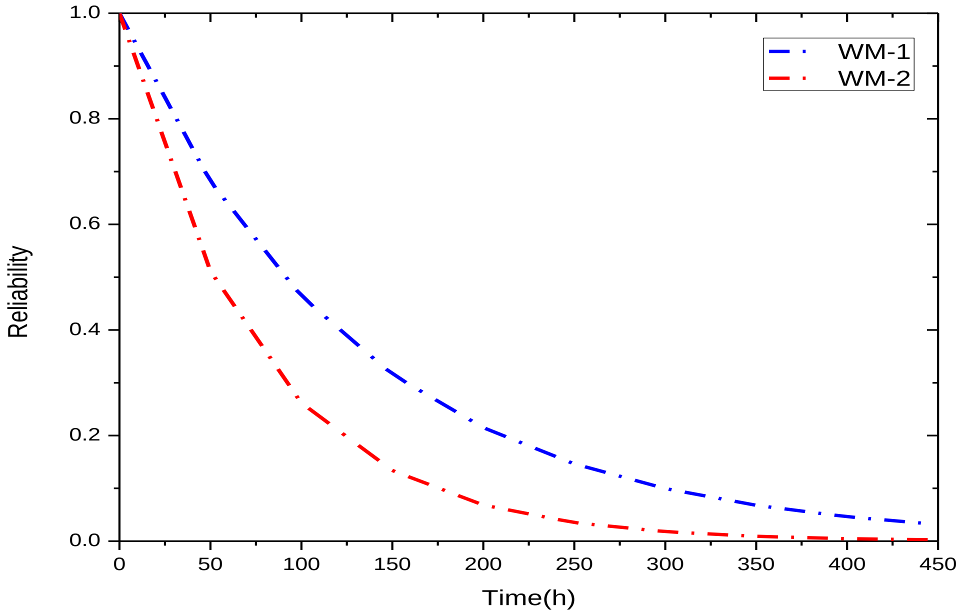

Figure 3: Comparison of reliability indicators of hydraulic subsystems WM -I and WM

$$R(t,z) = (\exp\left(-\frac{t}{166}\right)^{2.85})^{\exp(-1.138ENVCON-0.619MECHV-\ 0.699MP-0.521OP)}(6)$$

$$R(t,z) = (\exp\left(-\frac{t}{78.47}\right)^{2.23})^{\exp(-0.602ENVCON-0.472MECHV\ )}(7)$$

$$R(t,z) = (\exp\left(-\frac{t}{22.8}\right)^{1.79})^{\exp(-1.323ENVCON-0.447MP-0.423MECHV-0.271OP\ )}(8)$$

Figures 1, 2 and 3 show the graphs of the reliability of electrical, pneumatic and hydraulic subsystems WM - I and WM - at different times of operation. It can be seen from the figures that the degree of danger of both subsystems of machines at different times of operation has a significant difference. The reliability of the electrical subsystem of the WM machine decreased to 60% after about 300 hours of operation, while the reliability of the electrical subsystem of the WM decreased to 60% after approximately 150 hours of operation. The level of danger at different times for the pneumatic and hydraulic subsystems also showed a sharp decrease for the WM machine - compared to the WM subsystem - over time in operation [3]. Thus, the result of the reliability analysis showed that the operating condition has a great influence on the operation of the PSW machine and its subsystem.

Reliability level 90% 80% 70%

Electrical subsystem (h) 70100150

Pneumatic subsystem (h) 25 40 65

Hydraulic subsystem (h) 15 25 35

The reliability of the PSW and its subsystems can be improved by installing an appropriate maintenance scheduling system. The proposed reliability-based PHM application can plan maintenance intervals using derived PHM reliability graphs [26], which can optimize the level of machine reliability and estimate optimal periodic maintenance intervals for machine subsystems. For example, using the reliability graphs shown in Figures 1, 2 and 3, maintenance intervals are calculated for various levels of reliability of electrical subsystems WM -, which are presented in Table 1. To evaluate the optimal maintenance interval, the criticality of failures of PSW machines in the automotive industry is taken into account and proposed 90% reliability level. According to Table 1, in order to achieve 90% reliability of the electrical subsystem of the welding machine, a preventive inspection should be performed every 70 hours of operation. For the pneumatic subsystem, a reliability of 90% can be achieved if the test is carried out after 25 hours or almost after 4 shifts. The interval for the hydraulic system is 15 hours or after 2 shifts [2].

Table 1

Level of reliability	90%	80%	70%
Electric sub-system (h)	70	one hundred	150
Pneumatic sub-system (h)	25	40	65
Hydraulic sub-system (h)	15	25	35

The reliability model attempts to estimate how often a system fails to reach its operability and how long this situation takes. Two key points in building a model are the definition of failure criteria (which is defined as the non-functionality of the system) and the intrinsic nature of the system itself (whether the system is classified as disposable beyond repair). or, conversely, it can be reused or repaired. As far as failures are concerned, these may be the consequences of technology, materials, weather, third parties, or a combination of these factors. Therefore, the following is required:

Establish Establish detection of system failures (those caused by component failures) and classify them.

Determine the frequency of failures of different types and unavailable time windows. These options affect traffic interruption, schedule, number of canceled or delayed trains, traffic volume, etc.

Once a failure definition has been established, a decision must be made regarding the statistical processing of the system [5]. A natural choice is to consider maintainable systems, for which different processes can be defined:

Processes Renewal processes (RP): for repairable items, where maintenance activities restore items to a working state that is new (faultless repair), and for non-repairable items, when their fault data is identical and independently propagated (IID).

Non-homogeneous Poisson processes (NHPP): for repairable elements, where the maintenance action restores the element to a working condition as bad as the old one (minimum repair) [5].

General Renewal Processes (GRP): for repairable items, where the maintenance action restores the item to working condition to be somewhere between "good as new" and "bad as old" (imperfect repairs), and for non-repairable elements. items with trends in their historical data [27].

Complex systems in the aviation and automotive industries cannot be replaced after failure. When these types of systems are exposed to the environment, it is necessary to determine the reliability and other performance characteristics when using these conditions. The main data on the reliability of repairable systems is the time between failures. These data can be classified as complete or censored, where censored data is, by definition, a group of data in which the value of a measurement or observation is only partially known. For example, you may know when a device failed, but you may not know when the device was put into service or when it was installed.

• The process must be stationary or homogeneous. This means that the behavior of the system must be the same at all times, i.e. the probability of transition from one state to another must be constant in time.

• The various states a system may be in should be discrete and clearly identifiable [5].

These three criteria make it possible to apply the Markov approach to engineering systems whose behavior in space and time corresponds to a probability distribution characterized by a constant degree of danger, i.e.

Conclusion

Develop a new algorithm to predict the failure reliability of RSWS components and improve the accuracy of prediction using field monitoring data and historical failure information.

An algorithm for analyzing the reliability of the PSW machine is constructed . This algorithm is very useful for determining system reliability metrics (MTBF , MTTR and RAM) and for predicting component failure.

Determine the failure patterns of PSW machine components , failure rates, failure locations and failure modes.

Various factors affecting the reliability of the welding machine have been studied. The environmental factor is given special attention as the most significant. Data were obtained from two machines that operate in different operating conditions. The results showed that environmental factors significantly affect the reliability of the machine. The comparative study also showed that the necessary measures must be taken to maintain the reliability of the welding machine at a high level.

Output

1. A new algorithm has been developed for predicting the reliability of failures of components of welding equipment and the accuracy of prediction has been improved using equipment monitoring data.
2. The nature of failures of machine components, types of failures and frequency are determined.
3. Various factors affecting the reliability of equipment have been studied, where the environmental factor is given special attention as the most significant.
4. A model based on the statistical method PHM (proportional hazard model) to analyze critical equipment components and determine maintenance intervals.

List Of Used Literature

1. Schiedermayer, M., 1997. Improving the reliability of inverter-based welding machines. Welding journal, 76(2), pp.51–52.
2. Sharma, R.K. & Kumar, S., 2008. Performance modeling in critical engineering systems using RAM analysis. Reliability Engineering and System Safety, 93(6), pp.913–919.
3. Tomasevicz, C.L. et al., 2006. Preventive Maintenance Using Continuous- Time Semi-Markov Processes.
4. Tsarouhas, P.H., 2015. Performance evaluation of the croissant production line with reparable machines. Journal of Industrial Engineering International, 11(1), pp.101–110. Available at: http://link.springer.com/10.1007/s40092-014-0087-1.
5. Yefremov, A.A., 2015. Theory of reliability, Tomsk Polytechnic institute.
6. Zhang, H. and J.S., 2011. Defect Assessment of Spot Welds By Ndi,
7. Алиматов Баходыр Абдуманнонович, Садуллаев Хамидулло Мансурович, Файзиматов Улугбек Баходирович, Хаметов Замирбек Экономия энергии в экстракционной установке с пневмоперемешиванием жидкостей // Вестник БГТУ имени В. Г. Шухова. 2011. №4. URL: https://cyberleninka.ru/article/n/ekonomiya-
8. Husanov Y. Y., Abdullayev S. M., Sattorov A. M. MEXATRONIKA VA ROBOTOTEXNIKADA VIRTUAL LABARATORIYALARDAN FOYDALANISH //Scientific progress. – 2021. – Т. 2. – №. 7. – С. 337-342.
9. Ismael T., Yun S. B., Ulugbek F. Radiator heat dissipation performance. – 2016.
10. Ulugbek F. et al. A reliability-based preventive maintenance methodology for the projection spot welding machine //Management Science Letters. – 2018. – Т. 8. – №. 6. – С. 497-506.

11. Fayzimatov U. et al. Reliability analysis and maintenance optimization of projection spot welding machine in the automotive industry //International Journal of Performability Engineering. – 2018. – T. 14. – №. 8. – C. 1833.
12. Fayzimatov Ulugbek Bahodirovich, Мирзаева Гулчера Сотиволдиевна, & Abduvoxidov Shaxriyor Zikrullo o‘g‘li. (2022). STUDIES OF THE INFLUENCE OF INDEPENDENT VARIABLES (COVARIANTS) ON THE RELIABILITY CHARACTERISTICS OF EQUIPMENT. *Galaxy International Interdisciplinary Research Journal*, *10*(3), 192–199. Retrieved from https://internationaljournals.co.in/index.php/giirj/article/view/1445