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Reliability degradation and optimal maintenance for information equipment installed on railway cars

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A Reliability degradation model was developed in a project, which involved LCD TV screens installed on railway. One critical item in the project was an LED strip.
Accelerated Life tests data are the data source for the determination of LED Reliability. The expected life of LEDs being about 10-15 years - testing them until death is not practical.
Luminosity (vs time measurements provided by the manufacturer –were fitted to a degradation model. As opposed to [1] and [2], where an exponential degradation model for the average luminosity was applied our degradation model assumed degradation equations, based on the second law of thermodynamics developed by A. Einstein (1905), Fokker (1919) , Planck (1930) and Kolmogorov (1931). The main difference in the approaches is that the degradation function's Taylor expansion contains terms of the first and second derivative, while the models of [1] and [2] contain only the first.
As opposed to [2] we did not fit the results to an assumed Reliability function (Weibull, Normal, Lognormal) and left it in a tabular form. The table allows to determine required reliability and maintenance information.

The following results are derived:
1. PDF of the failure rate as a function of time
2. Reliability as a function of time and temperature (for simple and complex components)
3. MTBF for a device used for limited and unlimited life.

A model developed for maintenance costs and spare parts provisioning allows development Optimal Preventive Maintenance Policy :
1. Optimal preventive maintenance without individual monitoring.
2. Optimal preventive maintenance based on Rest of Useful Life (with monitoring)

References

1. Ott ,Melanie "Capabilities and Reliability of LEDs and Laser Diodes" Internal NASA Parts and Packaging Publication (1996).
2. J.Fan K_C Yung,M.Pecht Lifetime Estimation of High-Power White LED Using Degradation-Data-Driven Method IEEE TRANSACTIONS ON DEVICE AND MATERIALS RELIABILITY, VOL. 12, NO. 2, JUNE 2012
3. Si, Xiao-Sheng, et al. "Remaining useful life estimation based on a nonlinear diffusion degradation process." IEEE Transactions on reliability 61.1 (2012): 50-67
4. Livni, Haim. "Life cycle maintenance costs for a non-exponential component." Applied Mathematical Modelling 103 (2022): .261-286

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