TD 2

Reliability basics and Survival Analysis

Course : *Sûreté de fonctionnement & Retour d'Expériences*

(Dependability and Feedback Data Collection)

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I. A microwave transmitter has constant failure rate of 0.000 34 failure per operating hour.

a. Give the reliability function
b. M TT F and median time to failure.
c. Reliability for a 30-day continuous time period?
d. what is design life for a desired reliability of 0.95.

2. An electronic component suffers failures with CFR (constant failure rate) and M T T F = 1100 Hr. Compute following

   a. Reliability for a 200 Hr mission.
   b. Design life for 0.9 reliability
   c. The median time to failure.
   d. The reliability for a 200 Hr mission, if a second, redundant and independent component is added.

3. A Constant failure rate (CFR) system with failure rate of 0.0004 has been operating for 1000hr.

a. what is the probability that it will fail in next 100 Hr?
b. In the next 1000 Hr?

4. A turbine-blade experiences wear out in accordance with Weibull distribution with linear hazard rate function.

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$$\lambda(t) = \frac{2}{1000} \times \left(\frac{t}{1000}\right) = 2 \times 10^{-6} \cdot t$$

a. What are the shape and scale parameters?
b. Compute design life for a desired reliability of 0.99. (see the Gamma function chart).
c. Compute MTTF and variance.

5. Given a Weibull distribution with a shape parameter of 0.33 and scale parameter of 16,000, characterize the failure process.

6. If in problem 5, a 10-hour burn-in period is accomplished, then compute the new reliability function and design life for a 90 % reliability desired.

7. Le temps jusqu'à la défaillance, en heures de fonctionnement d'un composant critique, a un taux de défaillance (*hazard rate function*) :
$\lambda(t) = 0.003 \times (t/500)^{0.5}$ pour $t \geq 0$.

   a. Quelle est la fiabilité (*reliability*) si le composant doit fonctionner en continu pendant 50 heures.
   b. Déterminer la vie de conception (*design life*) si une fiabilité de 0,9 est souhaitée.
   c. Calculez le MTTF. ($(\Gamma\left(\frac{5}{3}\right) = 0.903)$
   d. Etant donné que le composant a fonctionné pendant 50 heures, quelle est la probabilité qu'il survive à un deuxième fonctionnement de 50 heures ?