Reliability

Lecture 1

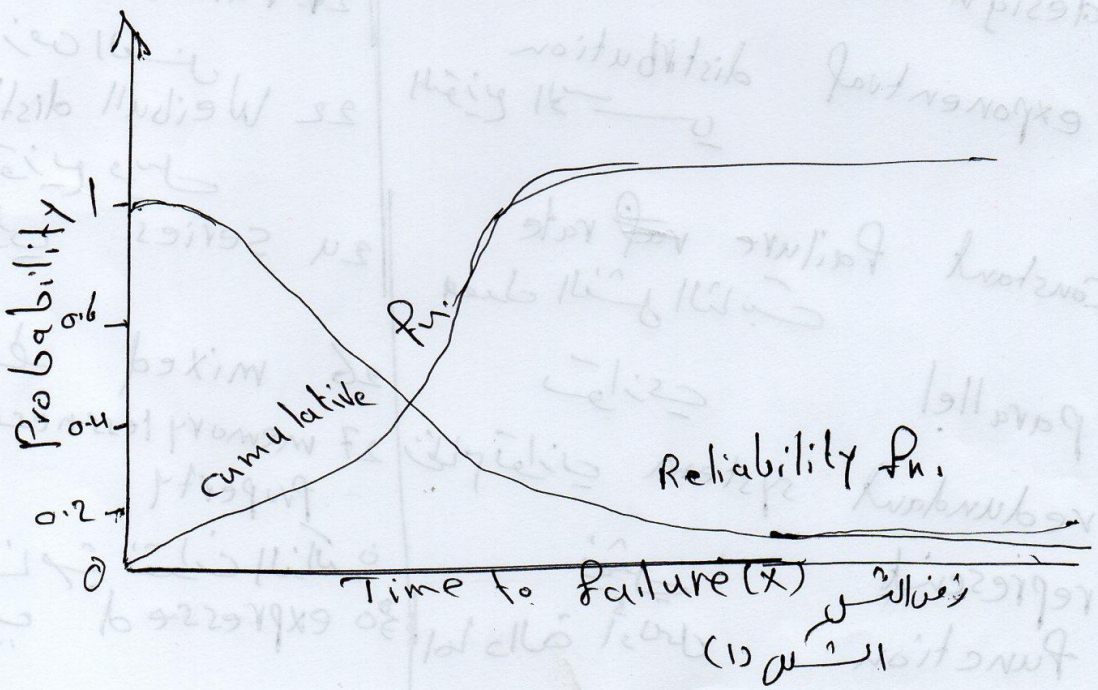
يرفق لكم اهم المصطلحات العلمية الخاصة بمادة المعولية

1- Reliability معولية
2- function دالة
3- Probability of failure احتمال الفشل
4- famous مهم
5- cumulative distribution الدالة التوزيعية
6- increase يزداد
7- probability of survival احتمال البقاء
8- decrease يقل
9- failure distributions توزيعات الفشل
10- system نظام
11 expressed موصوفة
12 component مركبة
13 probability of sucess احتمال النجاح
14 enable قادرة
15- conditional probability احتمال شرطي
16 complement متممة
17 modeling نموذج
18- median failure time وسيط زمن الفشل
19- design life عمر الحياة
20 failure time زمن الفشل
21 exponential distribution التوزيع الاسي
22 Weibull dist^{n}. توزيع ويبل
23 constant failure rate معدل الفشل الثابت
24 series توالي
25 parallel توازي
26 mixed مختلط
27 redundant system نظام توازي
27 memorylessness property خاصية فقدان الذاكرة
28 represent يمثل
29 function اما دالة أو تمثل
30 expressed عرف

31	hazard fn.	دالة المخاطرة
32	random variable	متغير عشوائي
33	Compressor	ضاغط
34	correspond	تطابق
35	mean time to failure (MTTF)	معدل العمر الزمني للفشل

1.1 The failure distribution

The reliability function is the complement of the cumulative distribution function (fn.). If the modeling the time to failure, the cumulative distribution function (fn.) represents the probability of failure and the reliability represents the prob'. of survival. Thus the cumulative distribution function increases from zero to one, as the value of x increases and



الشكل (1)

and the reliability fn. decreases

from 1 to zero as the value of x increases.

So the reliability is defined as the Prob^{y}. that the system (component) will function over some time period. To express this relationship mathematically, we define continous random variable (r.v) T to be the time to failure of the system (component) ; $T \geq 0$

then the reliability can be expressed as :-

$$R(t) = P_r(T \geq t) \quad \text{---------- (1)}$$

where $R(t) \geq 0$; $R(0) = 1$

$\lim_{t \to \infty} R(t) = 0$

i.e $R(t)$ is the prob^{y}. of time to failure is greater than time t

If we define $F(t)$:-

(4)

$$F(t) = \int_0^t f(s)\,ds$$

The reliability function enable the determination of the Prob^y. of success of units in

$$R(t) = 1 - F(t) \quad \text{---} \quad (2)$$

$$\Rightarrow F(t) = 1 - R(t)$$

$$R(t) = 1 - \int_0^t f(s)\,ds$$

$$\Rightarrow R(t) = \int_t^{\infty} f(s)\,ds$$

and $$f(t) = \frac{d\,F(t)}{dt}$$

$$f(t) = \frac{-\,d\,R(t)}{dt} \quad \text{---} \quad (3)$$

4.2 Failure rate or hazard fn.

The prob^y. of the same unit that will fail in the same time interval $t \le T \le t+\Delta t$ is the conditional probility of not failing before time t and failing in $t \le T \le t+\Delta t$ i.e

$$Pr\left(t \le T \le t+\Delta t \mid T \ge t \right)$$

$$= \frac{Pr\left(t \le T \le t+\Delta t \right)}{Pr\left(T \ge t \right)}$$

$$= \frac{Pr\left(t+\Delta t \right) - Pr\left(T \le t \right)}{Pr\left(T \ge t \right)}$$

$$= \frac{F(t+\Delta t) - F(t)}{R(t)}$$

The failure rate of the unit is :-

$$\lambda(t) = \lim_{\Delta t \to 0} Pr\left(t < T \le t+\Delta t \mid T > t \right)$$

$$\Rightarrow \lambda(t) = \frac{F(t+\Delta t) - F(t)}{R(t)} = \frac{f(t)}{R(t)} \quad \cdots (4)$$