1 Introduktion

1.1 Lite historia

Tillförlitlighet av tekniska system har inte studerats i mer än ca 60 år. Men man började redan under och efter Första världskriget med att studera funktionssäkerhet för en-, två- och fyra-motorsflygplan.

I början av 30-talet använde Walter Shewhart, Harold F Dodge och Henry G Romig statistiska metoder för kvalitetskontroll i industriella tillverkningssystem.

Etc. Läs i Rausand & Høyland.

1.2 Different approaches to reliability analysis

Rausand & Høyland skiljer på

- ⇒ hardware reliability,
  - – the physical approach (kallas ibland ”structural reliability”)
  - → the actuarial approach
- software reliability, och
- human reliability.

Läroboken (och kursen) behandlar främst ”hardware reliability”—”the reliability of technical components and systems” och ”approachen” är via livslängdsfördelningar för komponenter och system av komponenter, dvs ”the actuarial approach”.

1.3 Scope of the text

The main objectives of the book are

1. To present and discuss the terminology and the main models used in reliability studies.

2. To present the analytical methods that are fundamental within reliability engineering and analysis of reliability data.

1.4 Grundläggande begrepp

Reliability:

Quality:

Availability:

$$A(t) = P\,(\text{item is functioning at time } t)$$

$$A_{av} = \frac{1}{t}\int_0^t A(s)\,ds$$

Om man har en enhet som kan repareras så att den blir ”as good as new” varje gång den upphör att fungera tillfredsställande, så

$$A_{av} = \frac{\text{MTTF}}{\text{MTTF} + \text{MTTR}}$$

Maintainability:

Safety:

Security:

Dependability:

Tillförlitlighet kan mätas på olika sätt beroende på omständigheterna. T.ex,

1. Mean time to failure (MTTF)
2. Number of failures per time unit (*failure rate*)
3. The probability that the item does not fail in a time interval $(0, t]$ (*survival probability*)
4. The probability that the item is able to function at time t (*availability at time* t)

1.5 Tillämpningsområden

1. Risk analysis
2. Environmental protection
3. Quality
4. Optimization of maintenance and operation
5. Engineering design
6. Verification of quality/reliability

1.6 Modeller och osäkerheter

Jerzy Neyman (1945):

> Every attempt to use mathematics to study some real phenomena must begin with building a mathematical model of these phenomena. Of necessity, the model simplifies the matters to a greater or lesser extent and a number of details are ignored. The success depends on whether or not the details ignored are really unimportant in the development of the phenomena studied. The solution of the mathematical problem may be correct and you may be in violent conflict with realities, simply because the original assumptions of the mathematical model diverge essentially from the conditions of the practical problem considered. Beforehand, it is impossible to predict with certainty whether or not a given mathematical model is adequate. To find this out, it is necessary to deduce a number of consequences of the model and to compare them with observation.

George E P Box: “no model is absolutely correct. In particular situations, however, some models are more useful than others”

Ofta i konflikt med varandra är

- The model should be sufficiently simple to be handled by available mathematical and statistical methods.
- The model should be sufficiently "realistic" such that the deducted results are of practical relevance.

1.7 Standarder och direktiv

Hänvisning till en websida och Rausands e-postadress.

Kursens omfattning

- Livslängdsfördelningar
- Analys av system av (o)beroende komponenter
- Räkneprocesser
- Markovprocesser
- Underhållssystem
- Säkerhetssystem
- Analys av livslängdsdata
- Accelererad provning

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