1 Introduktion

1.1 Lite historia

Tillförlitlighet av tekniska system har studerats i ca 50 år. Man började 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 Høyland & Rausand.

1.2 Kursens omfattning

- Component and system reliability ⟵
- Structurel reliability
- Human reliability
- Software reliability

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.

1.3 Grundläggande begrepp

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

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

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)

1.4 Reliability management

1.5 Tillämpningsområden

1. Safety/risk analyses
2. Environmental protection
3. Quality
4. Optimization of maintenance and operation
5. Engineering dasign
6. Verification of quality/reliability

1.6 Fel och felklassificering

Failure
The termination of an item's ability to perform a required function.

Failure may be classified in failure modes:

Failure Mode
The effect by which a failure is observed on the failed item.

1.7 Modellbyggande

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.

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.

We will assume that the time for the component (system) failure can be noted exactly. The state of a given unit at time t can be expressed by a binary variable $x(t)$, where

$$x(t) = \begin{cases} 1 & \text{if the unit is functioning at time } t \\ 0 & \text{if the unit is failed at time } t \end{cases}$$

1.8 Standarder och direktiv