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Reliability / Availability
Description:

Nowadays, many terms which are part of the *Reliability Engineering* jargon are derived from the daily life's vocabulary. Even though these terms are, generally speaking, "comprehensible", they require to be delimitated and defined within the proper context, in order to have a clear understanding of what is *Reliability Engineering* about.

According to IEEE… /IEC… /MIL… /DIN…, **Reliability** can be defined as "the ability of an item to perform a required function specified by its intended purpose, under stated conditions during a given period of time".
Notwithstanding Reliability is not a quantifiable magnitude, all quantitative observations, as the quality of a system, refer to a finite and delimitated period of observations, in other words, the duration of the mission.
Moreover, in Reliability Engineering, Availability (A) is used as a quantitative magnitude.

According to IEEE… /IEC… /MIL… /DIN…, **Availability** refers to the probability of finding an item in an operational state at a given time".
Accordingly, availability is the relationship between two times, namely the average time of failure-free operation (during the mission) and the overall duration of the mission.

Furthermore, the average time of failure-free operation during the mission is known as the **Mean Time Between Failure (MTBF).**
This term is based on the assumption that when a failure occurs, the system does not generally remain in the down state for the rest of time the mission lasts, but is renewed or repaired.

Additionally, the time required for renewal or repair (i.e. from the start of the down state to the restoration of the up state) is known as the **Mean Time to Repair (MTTR),** often also called **Mean Down Time (MDT).**
If repairs are always carried out upon occurrence of a failure, then the duration of the mission is the sum of MTBF and MTTR.
For this standard, a practical case of availability is:

$$A = MTBF / (MTBF + MTTR)$$

Since technical systems are generally accepted and implemented only when they have high availability, A is a figure that is less (but very close) than 1.

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MTBF = Mean Time Between Failure (average failure-free time)

The term MTBF applies to parts, components, modules, subsystems, systems and plants.
In most cases the stress factor temperature of 40 degrees (C) is taken as a basis.

Calculations for parts, components and modules are based on the following standards

IEC 61709, SN 29500 and MIL-HDBK-217F

The "Parts Count" standard applies in this case. For instance, all component's failure rates are considered, regardless of the associated structure added (this does not apply to non-redundant system structures).

$$1 / (MTBF_{total}) = 1 / (MTBF_{part\ 1}) + \ldots\ldots\ldots\ldots + 1 / (MTBF_{part\ n})$$

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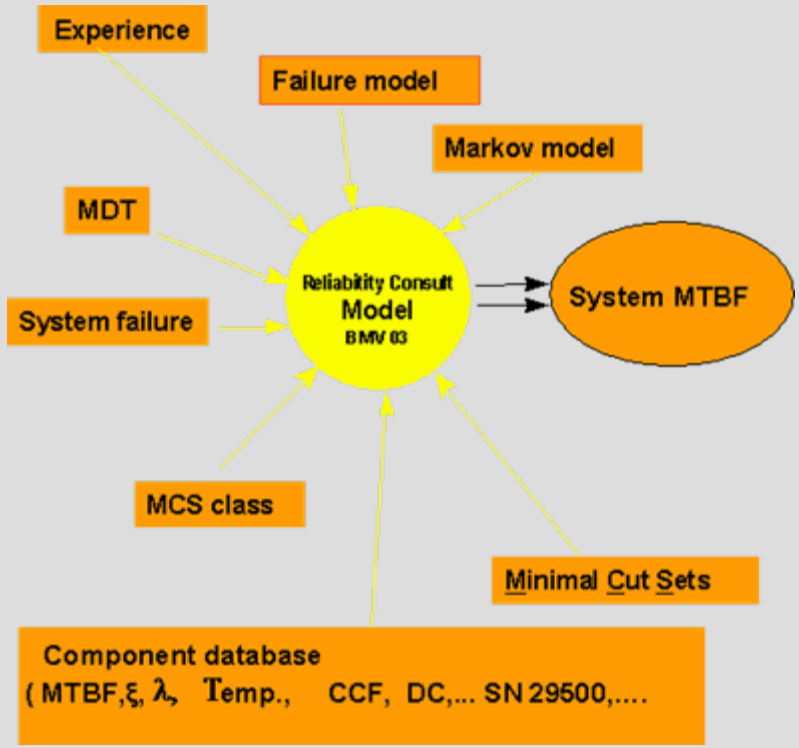
Calculations for subsystems, systems and plants are based on the following standards:

**IEEE 352, IEC 60300-3-1,
IEC 61069-5, MIL-STD 756B,
MIL-HDBK 338B.....**



A model is constructed based on the components, taking into account the associated structure.

$$MTBF_{total} = f(MTBF_{comp}, MTTR, CCF, DC, temp., \xi, structure, ...)$$

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