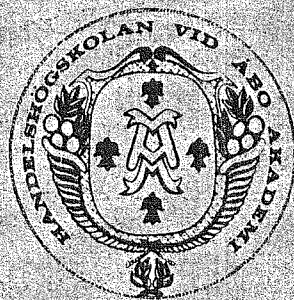


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SKRIFTSERIE UTGIVEN AV
HANDELSHÖGSKOLAN VID ÅBO AKADEMI

ON THE CONCEPT AND CHARACTERISTICS OF THE RELIABILITY OF A
PRODUCTION SYSTEM

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The paper deals with the concept and characteristics of system reliability, especially in the case when the system has several different levels of performance (when e.g. the failure of a component or subsystem only reduces the efficiency of the system instead of making it completely inoperable). The traditional concept of reliability is shown to be too narrow in extent in order to cover the systems with many (reduced) levels of performance.

In order to remove this deficiency, a new definition with an extension in contents is given for the concept of reliability. This conceptual extension is done so that

- the new more comprehensive concept in the case of general systems with many levels of performance has an analogous empirical interpretation to the interpretation of the traditional concept of reliability in ordinary two-stage "operable or inoperable" systems
- for two-stage operable or inoperable systems, the new concept coincides with the traditional reliability
- the new concept stays within the limits of the general mathematical definition of reliability (Gnedenko)

The quantitative definition of the new reliability concept is given in the form of four characteristics (which are now functions both on time and on performance level):

Availability with a level c of performance, $A_0(c,t)$ is

$$A_0(c,t) = P(\text{performance level of the system at time } t \text{ is } \geq c)$$

Mean availability of the capacity, $A_0(t)$ is

$$A_0(t) = \text{mean relative performance level of the system at time } t$$

Reliability with a level c of performance, $R_0(c,t)$ is

$$R_0(c,t) = P(\text{performance level of the system does not become less than } c \text{ during the whole interval from } 0 \text{ to } t)$$

Mean time to system failure below performance level c , $T_0(c)$

$$T_0(c) = \text{mean time after which the performance level of the system for the first time becomes less than } c$$

Expressions for calculating the new characteristics straight on the basis of the state probabilities are also derived in the paper. Some remarks on empirical interpretation and statistical estimation are given, too.