ponents Hybrids mfg Technol **CHMT-5** (3), 297 (1982) The reliability of high K multilayer ceramic capacitors was evaluated using accelerated life testing The degradation in insulation resistance was characterized as a function of voltage (two to eight times rated) and temperature (85 to 170°C) The times to failure at a voltage- temperature stress conformed to a lognormal distribution with a standard deviation typically less than 0 5 A small infant mortality population was also observed for some samples The results were least-squares fit to the following equation

$$\frac{t_1}{t_2} = \left(\frac{V_2}{V_1}\right)^n \exp\left(\frac{E_a}{k}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]\right)$$

where t is the median time to failure at V, the applied dc voltage, and T is the temperature in degrees Kelvin Subscripts 1 and 2 refer to the respective test conditions, and k is the Boltzmann constant The voltage stress exponent n was estimated at $2\,46 \pm 0.23$, and the activation energy, E_a $1\,19 \pm 0\,05$ eV with 95 percent confidence intervals The median time to failure at maximum rated conditions was estimated for a capacitor lot and failure rates were calculated

Statistical methods in accelerated testing of electronic capacitors lifetime MIECZYSLAW FRACKI and EUGENIUSZ PRZYBYL *Electron Technol* **13** (4), 31 (1982) In the report the applied methods of enhanced reliability testing of capacitors are analyzed The relations between lifetime distributions of capacitors during testing under constant and increasing exposure conditions are established The generalized gamma distribution as the most generalized lifetime distribution of capacitors, is proved to exist also during enhanced testing under increasing exposure condition The other existing distributions (Weibull power, exponential, etc) may be considered as particular cases of that distribution

The reliability of electronic components. Part 7: the reliability of hybrid integrated circuits. T J BAJENESCU *Feinwerktechnik Messtechnik* **90** (6), 309 (1982) (in German) The present sequence of descriptive articles covers here the modes and rates of failure, the sensitiveness to radiation, and the reliability testing of hybridequipped printed circuits The performance of the socalled beam leads is also being discussed

3. CIRCUIT AND SYSTEMS RELIABILITY, MAINTENANCE AND REDUNDANCY

Reliability dimensions for communication networks and their determination by calculation. K REINSCHKE *Nachrichtentechnik Elektronik* **32** (H11), 472 (1982) (in German) The usual reliability parameters do not suffice for the judgement of the reliability of communication networks First determined reliability dimensions which value the "damageability" of the network are represented Following it is dealt with the probability dimensions, single source—single sink reliability, single source—multisink reliability as well as total reliability and the problems associated with their determination mentioned As explanation an example being still overlookable is discussed

Reliability terminology and formulae for photovoltaic power systems. HAROLD A LAUFFENBURGER and RONALD T ANDERSON *IEEE Trans Reliab* **R-31** (3), 289 (1982) Photovoltaic (PV) solar energy systems operate in a unique environment compared with most electronic and electrical power generation systems The input stimulus, solar radiation, is both highly variable and noncontrollable This presents a certain amount of difficulty in measuring and reporting reliability, maintainability, and availability characteristics Many of the terms, definitions, and performance indices employed in other fields do not directly apply and need to be revised (tailored) to the PV technology This paper proposes reliability and availability terms, definitions, performance indices, and mathematical expressions The rationale for their relevance in photovoltaic solar energy technology and application is given There is a need to provide uniform terminology and formulae, for effective communication Such communication promotes the orderly development of a uniform and effective reliability methodology for PV systems and components The material draws extensively from ANSI/IEEE Standard-762, which defines reliability, availability, and productivity terms for electric power generation systems This paper extends the standard terminology to include PV power systems The unique characteristics of the PV array and the variability of input energy are described The language will grow as PV technology and associated reliability and maintenance methodology are further developed

Effects of materials and processes on package reliability DAVID NIXEN *Semiconductor Prodn*, 16 (1982) How to increase the level of reliability of semiconductor parts being used in electronic systems which have had their lifetimes extended through new and better system designs

Reliability impact of solar electric generation upon electric utility systems. JOHN T DAY and WALTER J HOBBS *IEEE Trans Reliab* **R-31** (3), 304 (1982) The introduction of solar electric systems into an electric utility grid brings new considerations in the assessment of the utility's power supply reliability This paper summarizes a methodology for estimating the reliability impact of solar electric technologies upon electric utilities for value assessment and planning purposes Utility expansion and operating impacts are considered Sample results from photovoltaic analysis show that solar electric plants can increase the reliable load-carrying capability of a utility system However, the load-carrying capability of the incremental power tends to decrease, particularly at significant capacity penetration levels Other factors influencing reliability impact are identified

An algorithm for fault-tree construction. J R TAYLOR *IEEE Trans Reliab* **R-31** (2), 137 (1982) An algorithm for performing certain parts of the fault tree construction process is described Its input is a flow sheet of the plant, a piping and instrumentation diagram, or a wiring diagram of the circuits, to be analysed, together with a standard library of component functional and failure models A systematic approach to component model construction is also presented

Capacity consideration in reliability analysis of communication systems. K K AGGARWAL, Y C CHOPRA and J S BAJWA *IEEE Trans Reliab* **R-31** (2), 177 (1982) This paper presents a simple method for deriving a symbolic reliability expression of some practical systems such as a communication system having fixed channel capacities of its links, a power distribution system having limited power ratings of its power lines, a transport system which might not allow traffic more than a particular value, or a chemical system in which oil or gas flow through pipes is permissible only up to some safe limits A system is good if and only if it is possible to transmit successfully the required capacity from source node to the sink node This paper defines a group as a set of branches such that success of these branches ensures system success, as defined above All such groups are obtained from a knowledge of the minimal paths of the system graph The method is computerized and implemented on DEC-20 computer Two examples are considered and their solutions presented to illustrate the technique

Patterns in listings of failure-rate and MTTF values and listings of other data. PETER W BECKER *IEEE Trans Reliab*