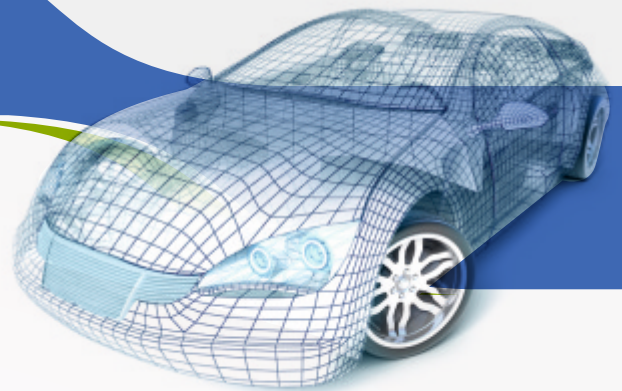




Computer-Aided Reliability Engineering for Electronics and Mechanical Systems



- ✓ MTBF Prediction for Electronic and Mechanical Parts Electrical Stress Derating
- ✓ Fault Tree Analysis (FTA)
- ✓ Failure Mode Effects (and Criticality) Analysis (FMEA/FMECA)
- ✓ Testability Analysis (TA)
- ✓ Reliability/Redundancy Block Diagram (RBD) Mean Time to Repair (MTTR)
- ✓ Safety and Risk Analysis (IEC-61508)

CARE® is an integrated suite of software tools and a database that are designed to help engineers analyze and improve product reliability and safety.

CARE® analyzes many types of component failures and their effects on system operational behavior and safety, using advanced failure rate prediction models, failure mode propagation and redundancy models.

Unlike other industry tools, CARE® provides all reliability analysis as a single, integrated system. CARE®'s comprehensive analysis includes traditional methods that adhere to ISO and IEC standards, as well as advanced RAMS and ILS analytical techniques.

The Challenge

The need to predict the reliability of complex electronic and mechanical systems early in their development is crucial to enhancing performance and eliminating system failures.

Engineers must employ multiple reliability analysis methods to cover potential product failures, as well as assess the required maintenance or design changes needed to improve reliability and meet safety requirements.

The CARE solution integrates all reliability analysis in a single application and database, thereby saving valuable time and money to provide an overall system view and assessment of how each failure will affect overall system operation.

CARE provides a full range of methods to assess system failure and provide decision support analysis for products and their performance.

CARE's ability to interface with well-known design CAD/CAE systems enables the engineer to use the data throughout the entire design process, thereby shortening the design cycle and reducing time to market.

A Single Set of Integrated Tools

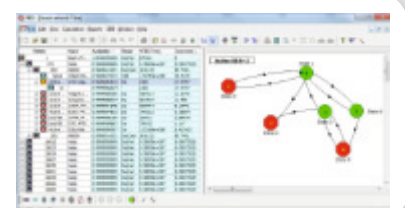
CARE provides engineers with an integrated framework for performing multiple RAMS analyses simultaneously. Designers using CARE benefit throughout the entire design process, from the early concept design, to performing RAMS allocation (top-down) and prediction analysis (bottom-up), to achieving final product reliability and safety approval.

Enhanced Safety Analysis

CARE utilizes advanced techniques that simplify the safety analysis process with ready-to-use models and can analyze large systems using a variety of redundancy types using IEC-61508.

Features & Benefits

- Provides reliability estimations during design
- Reduces the time required for RAMS analysis
- Helps identify and improve the most unreliable and critical parts
- Provides testability or design changes for enhancing system reliability
- Identifies consequences and risks of system failures
- Provides a dictionary of failure modes and their effects on system behavior
- Provides online Pareto results and recommendations – both tabulated and graphical
- Enables top-down allocation or analysis during the preliminary design
- Enables bottom-up prediction or analysis during full-scale development
- Recommends the optimal redundancy for high-availability systems





MTBF Prediction for Electronic Design

The CARE-MTBF module predicts component failure rates and presents the Mean Time Between Failure (MTBF) result for each assembly in a system tree using a serial reliability model. Component failure rates are predicted according to the latest version of the following models: Mil-HDBK-217, Telcordia, IEC-62308, SN-29500 Siemens, FIDES, GJB299, HRD and Rel-Tool Kit for Non-operational, including customized user-defined models.

Unique Advantages

- ✔ Automated parts library creation
- ✔ Built-in interface to popular CAD systems
- ✔ Mixes multiple prediction methods in a single project

MTBF Prediction for Mechanical Design

MTBF mechanical prediction uses two methods: CARE-NSWC-98 Standard (the prediction result is an exponential distribution) and MRS, as described below. MRS uses finite elements and Monte Carlo simulation.

Unique Advantage

- ✔ CARE-MRS: The Mechanical Reliability Simulation tool provides failure rate distribution, such as Weibull and other time-dependent distributions.

Stress Derating for Electronic Design

CARE helps designers select the correct components according to the stress load and temperature. The module compares operating stresses with allowed derated stress and recommends the replacement of overstressed and over-designed components. This analysis includes standard, military, industrial and customized derating profiles.

Unique Advantages

- ✔ Built-in standard derating guidelines
- ✔ Customizable derating profile editor

Fault Tree Analysis (FTA)

FTA calculates the probability and rate for all events in the fault tree including Cut-Sets.

The fault tree can be built automatically from CARE-MTBF, CARE-FMECA or CARE-RBD projects and can include common causes and dormant events. In addition to the standard gates, FTA includes the following gates: OR-Markov, AND-Standby, AND-Network and AND-Priority.

Unique Advantage

- ✔ Provides an interactive view that enables reliability engineers to dynamically change input data and view results online Superior calculation speed based on accurate solutions

Failure Mode Effects and Criticality Analysis (FMEA/FMECA)

FMECA complies with the M1629 and SAE standards (Reliability Priority Number-RPN), handles hardware and software functional trees, performs bottom-up analysis and automatically propagates failure modes to the Next Higher-level Effects via all functional blocks. This helps trace top-down failure causes for diagnostic procedures.

Unique Advantages

- ✔ Deploys a new effect type called Next Sibling Effect, in addition to the standard Next Higher Effect (NHE)
- ✔ Integrates both Normal and RPN FMEA styles
- ✔ Includes a library of standard and customizable failure modes for components and functions

Testability Analysis (TA)

TA analyses detection and isolation capabilities of built-in tests and ATE, providing non-detected and non-isolated failure modes in Pareto format. This helps optimize the system's self-diagnostic and ATE capabilities.

Unique Advantages

- ✔ Uses FMECA failure modes for Built-in test analysis
- ✔ Provides a Pareto report of undetected failed components or functions and specifies ambiguities

RBD – Basic, Network and Markov Models

Reliability Block Diagrams (RBD) can model complex redundant systems and provides calculation results for reliability, availability, down time, MTBF, MTTR, MTBCF, MTTCF and failure rates. Bottom-to-top results are provided for each assembly in the model hierarchy. The model can be used to allocate reliability parameters top down and to optimize redundancy and system architecture.

Unique Advantages

- ✔ A single integrated tool for networks, Markov and basic models
- ✔ Uses non-exponential failure rates for assemblies, such as Weibull and Log-Normal
- ✔ Network model includes many entry nodes to many output nodes (Multi-Pin model)

Mean Time to Repair (MTTR)

The MTTR module calculates the MTTR and Mct-max both for the entire system and for each assembly in the hierarchy using standard time libraries for standard maintenance procedures. The calculations comply to Mil-Std-472.

Unique Advantage

- ✔ Includes both a standard and a customizable library for standard maintenance times

Risk Assessment and Safety Analysis

The CARE-SIL application helps engineers evaluate various safety configurations according to the IEC-61508 standard, and provides the best Safety Integrity Level (SIL) configuration, periodic test intervals and cost. Additionally, the Safety Analysis module is integrated with other BQR applications that enable designers to optimize configuration redundancies and all related parameters (failure rate, repair time, diagnostic test interval, diagnostic coverage and more) quickly for optimal safety.

Unique Advantage

- ✔ Numerous redundancy scenarios can be created, based on the RBD model

Core Database

The BQR core database enables the creation of components that can be used across all BQR applications and enables engineers to work concurrently on different modules while using the same components.

