GRIF | Tree module

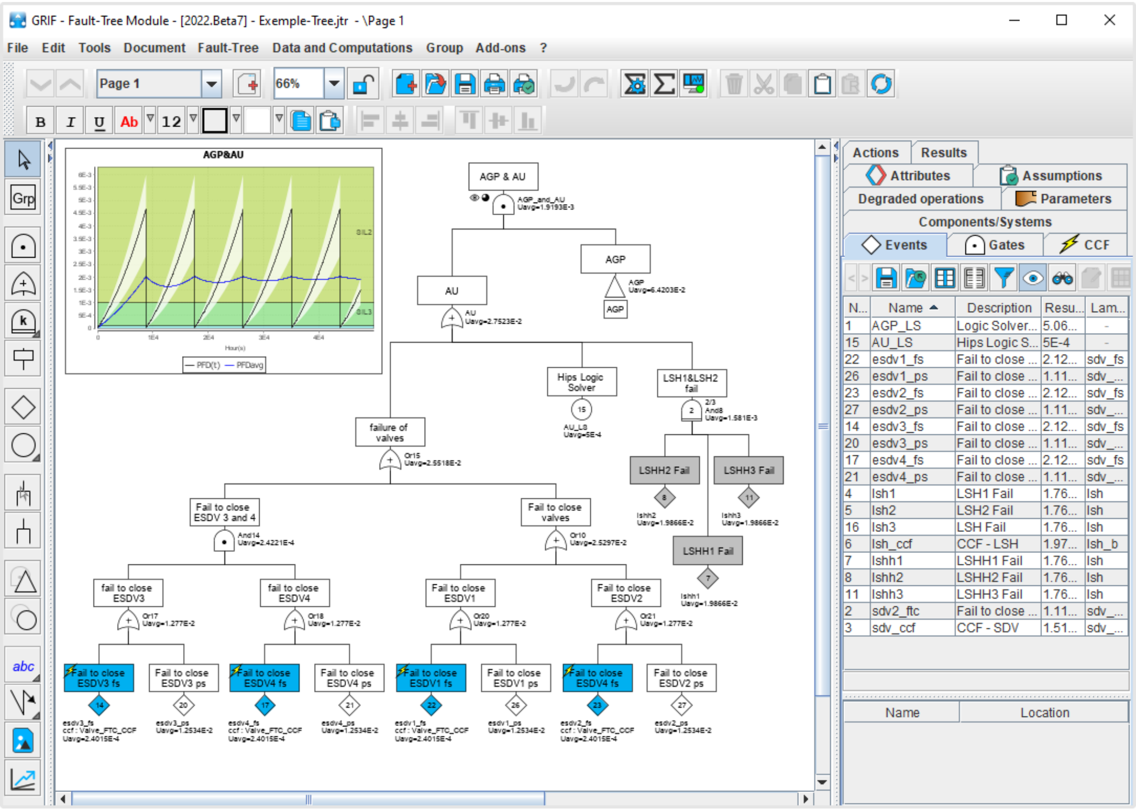
Technical sheet

To evaluate system architectures using Fault Trees

GRIF (GRaphical Interface for reliability Forecasting), a technology of TotalEnergies since the 80s, includes 3 packages and 12 modules allowing the user to choose the most appropriate modelling technique for the resolution of the studied system. Tree module is one of the seven modules belonging to Boolean package.

Tree is used to model a system as a **fault tree** based on Boolean logic, which produces simple models suited to all sectors (aeronautics, automobile, rail, oil & gas, etc.). This module uses **ALBIZIA**, the Binary Decision Diagram (BDD) computation engine developed by TotalEnergies. ALBIZIA brings the advantage of running **accurate analytical computations** and rapidly providing extensive information on the system under study.

Tree



Modelling and computations:

You can easily create fault trees via an **intuitive graphical interface**, and enter gates (AND, OR, K/N, NOT, XOR, NAND, NOR, IF-THEN-ELSE) according to the logic of the system studied and more than 20 probability laws: Exponential, Weibull, Gamma-Lambda-Mu, Exponential-Periodically-Tested, Weibull-Periodically-Tested…

In case of missing distribution, you can provide your **own probability distribution** with either a value-table or a **Markov graph**. When the tree is built, Common Cause Failure can be considered easily using different CCF models (Beta Factor, MGL, Shock models).

The “Attribute” feature (a custom property system) lets you add any information you want on each object of the document, either for more precise description or for traceability.

GRIF
GRaphical Interface for reliability Forecasting
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Hardware requirement: Intel Core i3 or faster, 4 GB of free RAM, 1 GB of free space, no internet connection needed. **Software requirements**: Windows 10 or Linux or MacOS X with Java 11. **Licenses**: standalone with USB dongle or Floating licenses with Sentinel server. Installable, laptop.

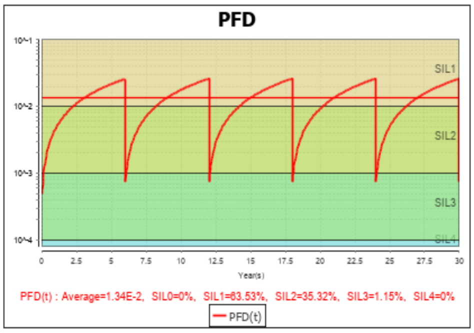
ALBIZIA, developed by TotalEnergies, provides many results for analytical computations:

- **Unavailability**: Q(t), U(t) or PFD(t), **Availability**: A(t), **Reliability**: R(t), **Unreliability**: F(t).
- **Frequency**: W(t), UFI(t) or PFH(t); and Failure rate: λeq(t), λv(t) or CFI(t).
- **Usual mean values**: MTTF, MTBF, MUT, MDT, number of failures.
- **Minimal cut sets** (probability and frequency of cut sets).
- **Reliability allocation**.
- **Many importance factors** (Birnbaum MIF, Critical CIF, Vesely, DIF, etc.) that help users find system weaknesses and improve them.

Specificities and strengths:

- **Computing the time spent in the SIL zones:** in addition to the computations mentioned above, **ALBIZIA is the only engine able to compute how long the PFD(t), PFH(t) or EqLambda(t) of a system spends in an interval during its mission period.**

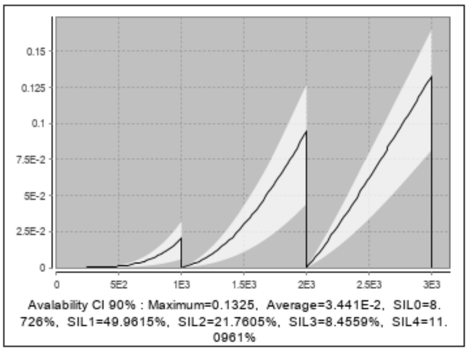
  The figure shows a mean availability of 8.44E-3, which corresponds to a SIL2. However, it also indicates the percentage of time the system spent in each SIL over its 30-year mission. In this case, 39.77% of its time was spent in SIL1.



- **User-friendliness:** Groups/sub-trees are easy to create and with the automatic layout function, users can effortlessly organize their tree simply by pressing F7. The sub-tree templates facilitate tree construction for systems that use equipment that is already known. In addition to an editing window for each object, GRIF comprises data-tables that make it easier to control the quality of input data and help users to make modifications (find/replace, suffixes, prefixes).

  GRIF has plugins for entering input data, obtained either from in-house feedback from the field, or from standards, or from commercial sources. Users will save time in finding accurate input data.

- **Factoring in uncertainties:** To be as close as possible to real conditions, parameter-related uncertainties can be factored in. It is possible, for example, to specify that a failure rate follows a Uniform, Normal or Log-normal distribution. A **Monte-Carlo simulation** is performed in addition to the BDD computation in order to obtain mean values. Finally, a quantile computation is run to provide a dispersion interval on each result. It can be a 60, 70, 80, 85, 90, 95 or 99% interval (centered or not).
  N.B. it is a requirement of the IEC standard 61511.



Using data and results:

- Possibility of automating calculations (batch runs) and drawing variations for sensitivity analysis.
- Results are stored in the document and can be exported in a variety of formats (csv, XML, Excel, etc.).
- Results can be viewed as line graphs, pie charts or histograms.
- Vectorial printing in PDF format generates high-quality pictures but the files are small enough to be sent by e-mail even if the document contains hundreds of pages.
- External files (PDF certificates, system pictures, etc.) can be included in the document and be part of the full report.
- Interaction with the operating system: possibility of copying/pasting to or from word processing software, spreadsheets, or presentation tools.

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Trial version available on
grif.totalenergies.com