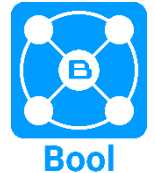


GRIF | Bool module

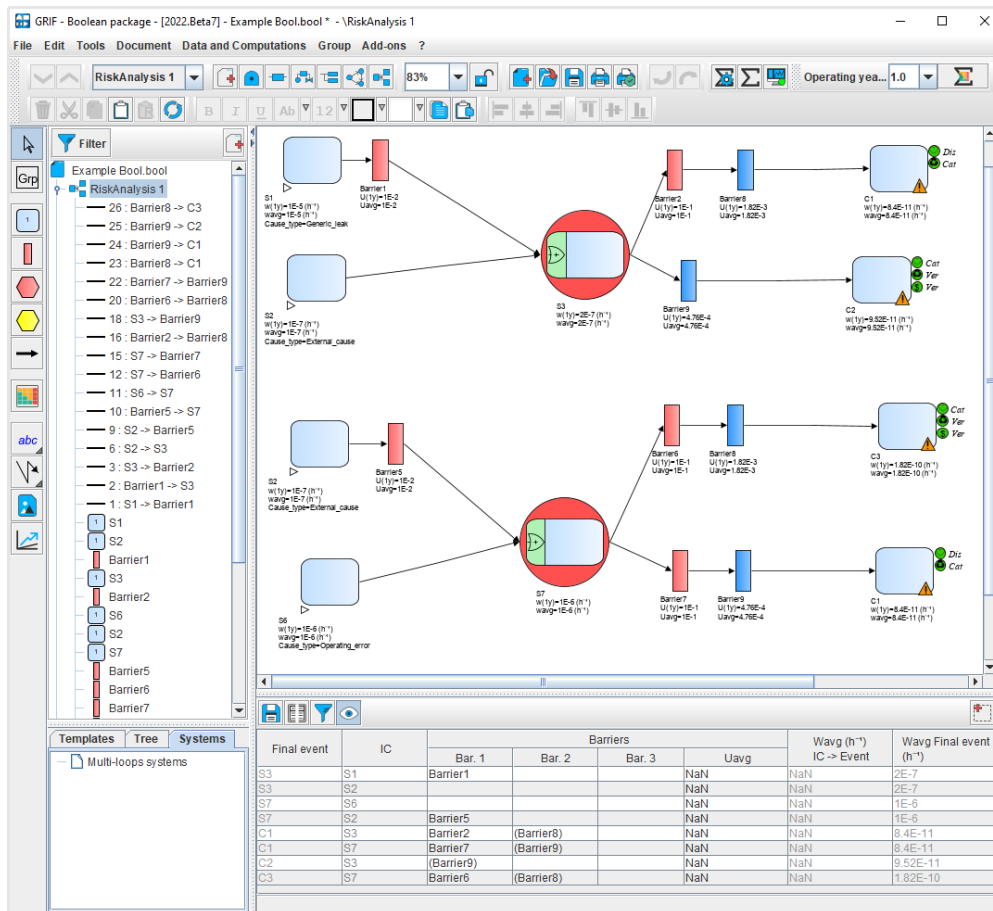
Technical sheet

To evaluate system architectures using Boolean approach



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. Bool module is one of the seven modules belonging to Boolean package.

Bool combines the functions of all the GRIF Boolean package modules. Fault Trees (Tree), Event Trees (ETree), Reliability Block Diagrams (BFiab), Safety-Instrumented Systems (SIL), Reliability-Network (Reseda), Bowtie and LOPA tables (Risk) can all be included in the same document, which can then be used for bow-tie risk assessments or LOPA-type analyses, using complex safety barriers or any other model that requires a combination of different representations.



Modelling - intuitive creation and import:

If you are already familiar with the different modules in our **Boolean package**, you will have no trouble creating models using Bool. **The graphic interface is similar to that**

of reference modules, making it easy to create models.

In addition, Fault Trees and Event Trees, Safety Instrumented Systems, Reliability Block

Diagrams, Reliability Networks and Bow-Ties can be **imported separately into the same Bool document.**

GRIF

GRaphical Interface for reliability Forecasting
August 2022

TotalEnergies SE

CSTJF
64018 Pau Cedex - FRANCE
Phone : +33 (5) 59 83 40 00
grif.totalenergies.com

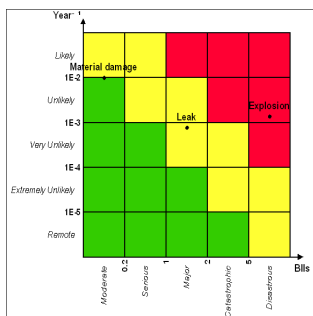
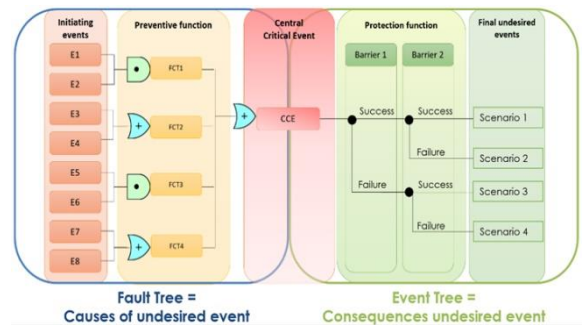
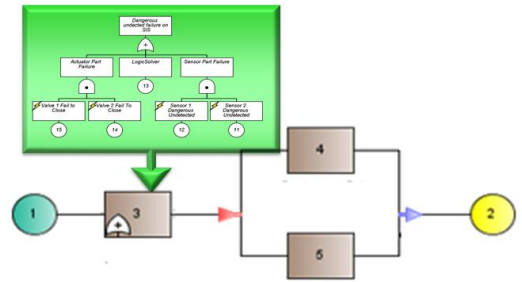
Hardware requirement: Intel Core i3 or faster, 4 GB of free RAM, 1 GB of free space, no internet connection needed. **Software requirements:** Windows 10 or Linux or MacOS X with Java 11. **Licenses:** standalone with USB dongle or Floating licenses with Sentinel server. Installable, laptop.

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

All computation possibilities (probabilities, frequencies, minimal cut sets, importance factors, etc.) in the ALBIZIA engine, are already available in each module in the Boolean package and are also featured in Bool. The model uses BDD (Binary Decision Diagram) computations to provide accurate results.

Specificities and strengths:

- Flexibility and level of details:** Depending on the level of accuracy needed, the Bool module allows components to be detailed component (such as a block) using another model (a Fault Tree, for example), which gives users greater flexibility when modelling. They can detail sub- systems if necessary or keep a more general functional description. Comparative sensitivity studies can be performed easily by creating different system architectures and launching the calculations with a specific configuration for each system.
- Bow-tie assessment:** In the industrial world, probabilistic risk assessments help prevent major accidents and are a two-phase process. First, the unwanted event and its causes are identified, then the sequence of barrier failures is analyzed to determine the scenarios. A bow-tie assessment focuses on that issue by identifying all the accidental sequences and quantifying the frequency of occurrence of the unwanted event.



Now that this type of study is gaining ground in risk assessments, the Bool module provides an exact evaluation of the frequency of occurrence of a scenario, without any approximations. Elements common to the different barriers can also be more easily considered thanks to the "repeated object" and "references" settings.

Computations are run on an event tree and presented in the matrix defined by the user, with each scenario (or consequence) positioned according to the results (X-axis) and the severity specified by the user (Y-axis).

Using data and results:

All the Boolean module functions are accessible in Bool:

- Input data is summarized in spreadsheet format, making it easy to control the quality of an entry, for example.
- Databases can be connected, to retrieve values and use them as settings.
- Models and curves can be printed as vectors in PDF format.
- Results stored in a single document can be exported in different formats (csv, XML, Excel, etc.).
- Results can be viewed as line graphs, pie charts or histograms.

