Fault Tree/Event Tree/PRA

Relex
A PTC InSight Product

Fault Tree analysis (FTA), Event Tree analysis (ETA) and Probabilistic Risk Assessments (PRA) are techniques used to model the safety of a system.

Fault Tree Analysis

A fault tree analysis (FTA) is a deductive, top-down method of analyzing system design and performance. It involves specifying a top event to analyze (such as a fire), followed by identifying all of the associated elements in the system that could cause that top event to occur.

Fault trees provide a convenient symbolic representation of the combination of events resulting in the occurrence of the top event. Events and gates in faulttree analysis are represented by symbols.

Fault tree analyses are generally performed graphically using a logical structure of AND and OR gates. Sometimes certain elements, or basic events, may need to occur together in order for that top event to occur. In this case, these events would be arranged under an AND gate, meaning that all of the basic events would need to occur to trigger the top event. If the basic events alone would trigger the top event, then they would be grouped under an OR gate. The entire system as well as human interactions would be analyzed when performing a faulttree analysis.

Relex Fault Tree/ Event Tree

Relex Fault Tree/Event Tree enables you to quickly and conveniently analyze complex systems. You can enter gates and events and assign their individual properties using just a few mouse clicks. When finished, the software performs fast and accurate calculations analyzing your system safety.

Event Tree Analysis

An event tree analysis (ETA) is a visual representation of all the events which can occur in a system. As the number of events increases, the picture fans out like the branches of a tree.

Event trees can be used to analyze systems in which all components are continuously operating, or for systems in which some or all of the components are in standby mode - those that involve sequential operation logic and switching. The starting point (referred to as the initiating event) disrupts normal system operation. The event tree displays the sequences of events involving success and/or failure of the system components.

The goal of an event tree is to determine the probability of an event based on the outcomes of each event in the chronological sequence of events leading up to it. By analyzing all possible outcomes using event tree analysis, you can determine the percentage of outcomes which lead to the desired result.

Probabilistic Risk Assessment

Risk is a term used across governments and industries to classify the likelihood and outcome of events. Phrases such as "highly probable" or "catastrophic" may be sufficient classifications for many applications. However in cases where consequences could mean loss of human life or millions of dollars in assets, decision-makers look for numbers as a more solid basis on which to quantify risky decisions and the uncertainty of these decisions.

Thus arose the concept of Probabilistic Risk Assessment (PRA), which may also be called Quantitative Risk Assessment (QRA) or Probabilistic Safety Assessment (PSA). Historically, PRA has been applied in the nuclear, chemical, and aerospace industries. More recently, it has been emerging in construction, transportation, financing, and management planning.

PRA is a well-established technique for integrating various reliability modeling tools, such as Fault Tree, Event Tree, and even Reliability Block Diagram (RBD), and FMEA to numerically quantify risks. The PRA sets out to determine what hazardous scenarios can occur, what is the likelihood they can occur, and what are the consequences given they occur. It uses statistical reliability data for basic events to answer these questions.

The first step of a Probabilistic Risk Assessment is to identify an undesired top event, such as "loss of life" or "loss of mission," and trace out all the hazards that could lead to this event. This is usually conducted through the use of event trees, in which the hazards become the initiating events. For the initiating events and all subsequent intermediate events, fault trees are developed. At the lowest level, the basic events of the fault trees are assigned probabilities. These probabilities are propagated up the logic to reach a probability (and uncertainty) of the undesired top event. PRA is a key tool in safety management. Software to implement PRA is necessary for any large-scale system due to the large, complex logic chains that must be analyzed. Using Relex Fault Tree/Event Tree, the analyst can allow the software to do the logic calculations automatically and can concentrate on the safety engineering. Software links between faulttree top events and the events in event tree can be easily associated. Thus Relex proves to be a valuable safety software tool for any PRA program.