

Improved Features in a PSA Software AIMS-PSA

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1. Introduction

KAERI has been developing an integrated PSA (Probabilistic Safety Assessment) software package whose temporary name is OCEANS. The OCEANS includes the softwares for Level-1, 2 & 3 PSA, fire PSA, seismic PSA and shutdown PSA [1].

The AIMS-PSA software [2] plays a key role in the OCEANS, which takes charge of the event tree and fault tree analysis. The AIMS-PSA has been developed in 2005 and used for several PSAs developed for regulatory purpose [3]. Even though it has a lot of useful features for the event tree and fault tree analysis, it is not easy to use by non-experienced PSA persons and it is based on the outdated Visual Basic 6.

KAERI has developed the new AIMS-PSA2 to solve the problems discovered in the AIMS-PSA. Those are;

- Improve the design to be more intuitive
- Improve the quantification and review of the PSA model
- Improve the capability for sensitivity analysis

2. Improved Features in the AIMS-PSA2

In this section the improved features of the new AIMS-PSA2 are described.

2.1 Intuitive Design for the User Interface

The new AIMS-PSA2 is developed using the Visual Basic 2008 to take advantages of the new software technology. It introduces a docking window that is adopted in many softwares.

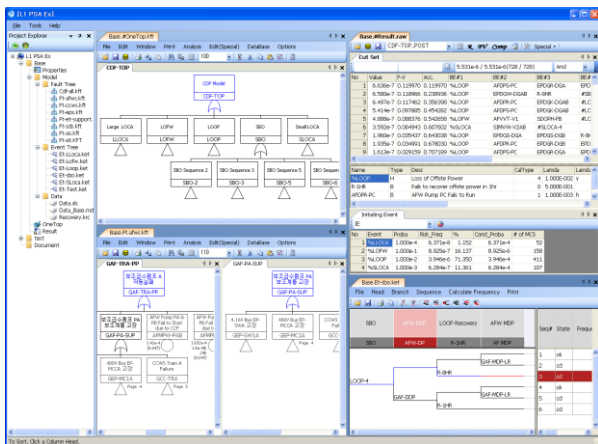


Fig. 1. The user can move and resize any window as the user likes. Meanwhile, each window was displayed like as different software in the old AIMS-PSA.

One of problem in the old AIMS-PSA was that it was not intuitive. It was not easy for even the experienced PSA persons to use without the detailed manual and guide.

The project explorer is introduced to provide the easy access to the model. The project explorer provides menus to do most of the work such as browsing each file, quantifying the PSA, and viewing the result.

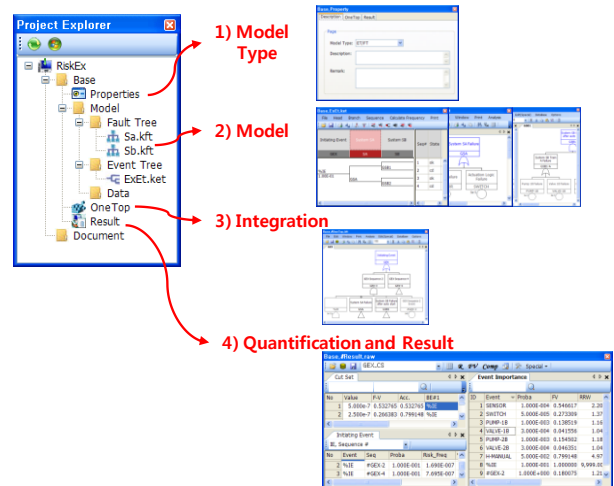


Fig. 2. The project explorer displays all files included in a PSA model. It is designed to follow the work flow such as modeling, integration, and quantification. Given a PSA model, just executing two menus (for integration in one top and quantification in result) in the project explorer finishes the quantification of the PSA.

2.2 Integration for Quantification and Review

The key concept of the AIMS-PSA is integration. The AIMS-PSA automatically builds the one top fault tree from the event trees, fault trees and data.

One time quantification (generating the cut sets) for the one top fault tree is enough to get the information necessary for the PSA, which takes less than 10 seconds for most level-1 internal PSA model. From the cut sets, the AIMS-PSA provides cut sets and CDF (Core Damage Frequency) for every sequence, cut sets and frequency for whole core damage, CDF for each initiating event, and importance measures of events and components.

Several features are implemented to help the review of the PSA model.

One is a feature to trace the relation between event tree, fault tree and cut sets. It makes easy to review the PSA model and result.

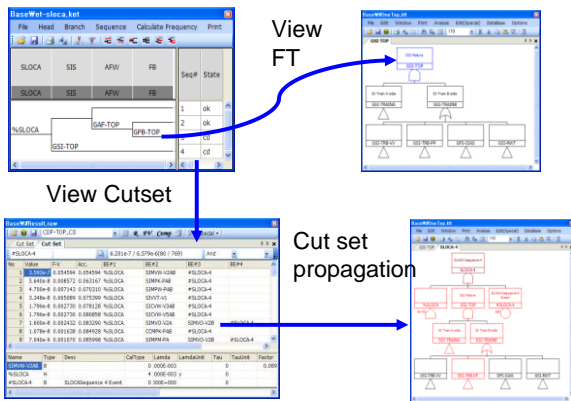


Fig. 3. The user can jump to the fault tree corresponding to a branch or a sequence of an event tree, or jump to the cut set corresponding to a sequence of an event tree. Propagating a cut set thru the one top fault tree helps to review the fault tree logic how the cut set is generated.

The second is to find a gate or an event in a fault tree. The user can find the list of events whose name matches the filter, and open fault trees from the list.

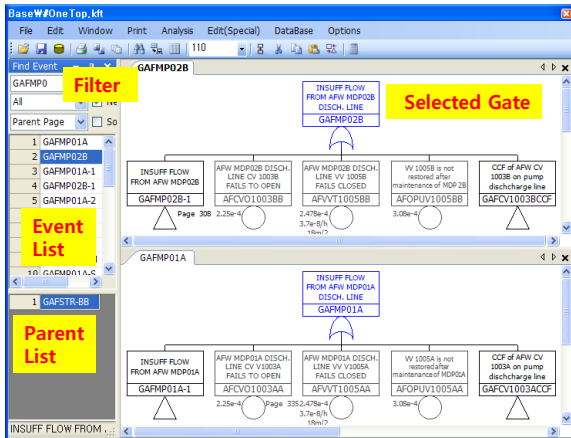


Fig. 4. An example to find and compare fault trees having similar logic.

The third is to compare the cut sets. It distinguishes cut sets into 4 categories; the same (gray), no relation between cut sets (white), absorbed by another (cyan) one (yellow), and absorbing another one.

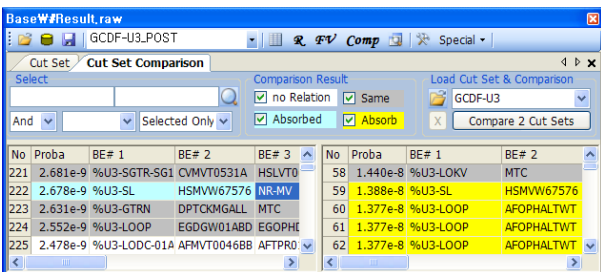


Fig. 5. The 222-th cut set of the left side is absorbed by the 59-th cut set of the right side.

2.3 Sensitivity Analysis

The risk analysis of operational event is performed to evaluate the risk affecting on a plant from any event

occurring in the plant [4]. The risk monitor is used in many nuclear power plants for this type of analysis [5]. The MPAS-OOS module provides a capability to do more detailed analysis than the risk monitor. The user can change the value or status in a PSA model to incorporate the effect of an event.

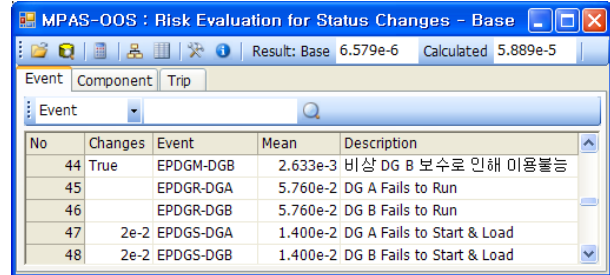


Fig. 6. The MPAS-OOS provides a feature to modify the input to incorporate the event which has occurred in a plant

3. Conclusions

The new AIMS-PSA2 has been developed to solve the problems discovered in the old AIMS-PSA. It was developed using Visual Basic 2008 to take advantages of the new software technology. The user interface was improved for the non-experienced persons in the PSA to perform the analysis easily and intuitively with short term training. Given the PSA model, just few button clicks generates the results. The features for tracing and reviewing the model were also enhanced. The MPAS-OOS enables the user to perform the event analysis from the viewpoint of risk.

The new AIMS-PSA2 plays a key role in the OCEANS package which is being developed for all modes-all hazards analysis of a PSA.

Acknowledgement

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