Characteristics of Risk Informed Applications Tool, ARMMS

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1. Introduction

Many risk informed regulation & applications (RIR&A) are approved and used for the nuclear power plants(NPPs), and more RIR&A will be actively applied in Korea. Also, since Korean NPPs are recently exported to other country such as UAE, RIR&A would be applied to the exported NPPs. Thus, a tool which will help the user apply RIR&A is required. KAERI is being developing a tool, called ARMMS (Advanced Risk Management and Monitoring System), for this purpose.

This paper introduces the scopes and characteristics of ARMMS.

2. Scopes and Characteristics of ARMMS

2.1 Scopes of ARMMS

As shown in Fig. 1, ARMMS can be used for many RIR&A such as risk-informed in-service test (RI-IST), risk-informed ISI (RI-ISI), risk-informed tech spec (RI-TS), Option 2, on-line maintenance (OLM), MSPI (mitigating system performance index), maintenance rule (MR), accident sequence precursor (ASP), and significance determination process (SDP). In Fig. 1, ARMMS can be used with all modes all hazard concept. In other words, the decision makings of RIR&A are made with all modes all hazard PSA models in ARMMS. The PSA tool used in ARMMS is AIMS[1] with FTREX [2] quantification engine.

The general operating concept of ARMMS is; first, manipulate an input module, and second, select output fields to appear on the screen, and then output screen shows up. Fig. 2-3, which are example screens for RI-IST and OLM, respectively, show well this operating concept. Other example for Option 2 is shown in Fig. 4

2.2 Characteristics of ARMMS

The characteristics of ARMMS are followings; The PSA model used in ARMMS contains enough BOP models which can show the change of trip frequencies. Thus, ARMMS which can provide the change of trip frequency help a plant manager make better decision making in some RIR&A such as OLM. Another characteristic is that ARMMS monitors the performance index reflecting the unreliability and unavailability history of each SSCs (structures, systems, and components) in each RIR&A. The other characteristic is that the program function and calculation algorithms required to each RIR&A in ARMMS can be easily adapted to the request of the users since the ARMMS is using SIMMA[3] of AIMS which is a very flexible and powerful interpreter of the users' file where data and logic can be easily modified. An example of the SIMMA is shown in Fig. 5.

3. Conclusions

ARMMS is being developed to be used in RIR&A. The characteristics and scopes of ARMMS are discussed. ARMMS has BOP model which can offers a trip frequency and an accurate CDF, can monitor performance index of each RIR&A, and can be easily adapted to the request of the users by using the SIMMA.

Acknowledgement

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REFERENCES

[1] S.H. Han, et. al. Improved Features in a PSA Software AIMS-PSA, Trans. of the Korean Nuclear Society Spring Meeting Pyeongchang, Korea, May 27-28, 2010

[2] Woo Sik Jung, et al., "A fast BDD algorithm for large coherent fault trees analysis," Reliability Eng. & Systems Safety 83, 369-374, 2004

[3] S.H. Han, et. al., AIMS-PSA Release 2 Reference Manual, Rev 1.0, KAERI-ISA-MEMO-AIMS-03-KOR, June 2010

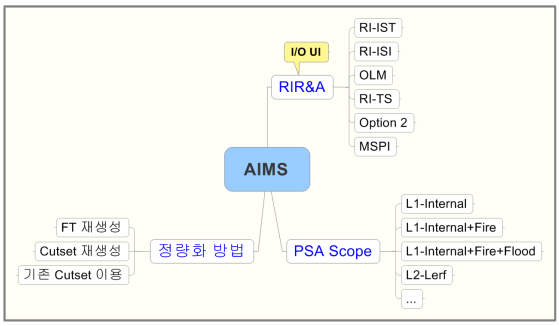
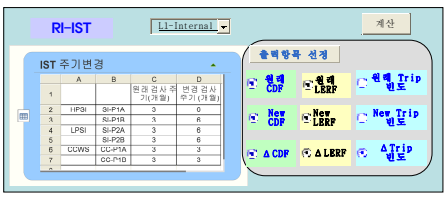
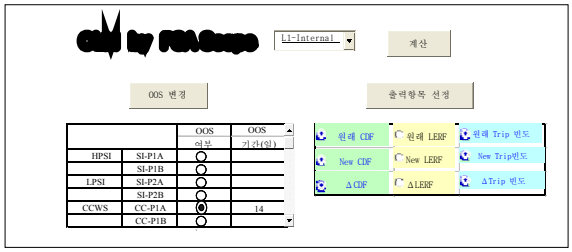


Fig.1. ARMMS for Many RIR&A Based on AIMS



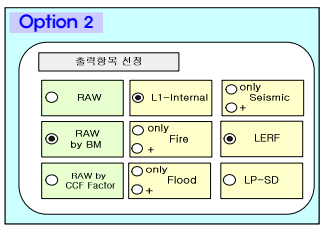
				CDF	New CDF	ΔCDF	LERF	New LERF	ΔLERF	Trip	OK
HPSI	SI-P1A	3	6								
	SI-P1B	3	6								
LPSI	SI-P2A	3	6								
	SI-P2B	3	6								
CCWS	CC-P1A	3	3								
	CC-P1B	3	3								

Fig. 2. An example screen of RI-IST in ARMMS



		변경 검사 주기 (개월)	원래 CDF	New CDF	ΔCDF	원래 Trip빈도	New Trip빈도	ΔTrip 빈도
CCWS	CC-P1A	14	5.46E-6/yr	5.472E-6/yr	1.2E-8/yr	0.3875/yr	0.4066/yr	0.00073
합산 결과			5.46E-6/yr	5.472E-6/yr	1.2E-8/yr	0.3875/yr	0.4066/yr	0.00073

Fig. 3. An example screen of OLM in ARMMS



Option 2		L1-Internal FV	LERF FV	L1-Internal RAW(BM)	LERF RAW(BM)	RISC
HPSI	3441SI-V0659	0.006075	0.016905	4.3	10.51	I
	3441SI-V0660	0.006305	0.016963	4.42	10.18	I
LPSI	3441SI-V0306	0.002296	0.003773	2.82	3.9	I
	3441M-PP01A	0.000159	0.000174	1.27	1.29	III
CCWS	3461CC-V1014	0.000002	0.000003	10.43	11.56	I
	3461M-PP01A	0.000323	0.000353	1.07	1.1	III

Fig. 4. An example screen of Option 2 in ARMMS

```
Add+ AA BB
Gate G   *   L1   L2
Value   CC   0.01
Value   DD   0.2
Set A True
Set E False
```

Fig. 5. A SIMMA file of AIMS