Development of the RSAC Automation System for Reload Core of WH NPP

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1. Introduction

The Nuclear Design for Reload Core of Westinghouse Nuclear Power Plant consists of "Reload Core Model Search", "Safety Analysis(RSAC)", "NDR(Nuclear Design Report) and OCAP(Operational Core Analysis Package Generation)" phases. Since scores of calculations for various accidents are required to confirm that the safety analysis assumptions are valid, the Safety Analysis(RSAC) is the most important and time & effort consuming phase of reload core design sequence.

The Safety Analysis Automation System supports core designer by the automation of safety analysis calculations in "Safety Analysis" phase(about 20 calculations, see Fig. 2). More than 10 kinds of codes, APA(ALPHA/PHOENIX/ANC), APOLLO, VENUS, PHIRE XEFIT, INCORE, etc. are being used for Safety Analysis calculations. Westinghouse code system needs numerous inputs and outputs, so the possibility of human errors could not be ignored during Safety Analysis calculations. To remove these inefficiencies, all input files for Safety Analysis calculations are automatically generated and executed by this Safety Analysis Automation System. All calculation notes are generated and the calculation results are summarized in RSAC (Reload Safety Analysis Checklist) by this system. Therefore, The Safety Analysis Automation System helps the reload core designer to perform safety analysis of the reload core model instantly and correctly.

2. Methods and Results

2.1 Creation of Code Input Deck

This Safety Analysis Automation System generates code input deck based on reference data (plant data, previous cycle's reference input deck) and designer defined data sets. Because the system automatically applies appropriate keyword related to project and cycle, designer's efforts are minimized. The input data need to be referred from the other calculation result, automatically cited from the reference output file by this system[*].

2.2 Execute Code

Generated input decks by this system are transferred to HP server through FTP module and run as a batch process. The batch process using input deck list file which is created by this system while transferring input files, controls all code execution sequences and finish server side process without interference of reload core designer..

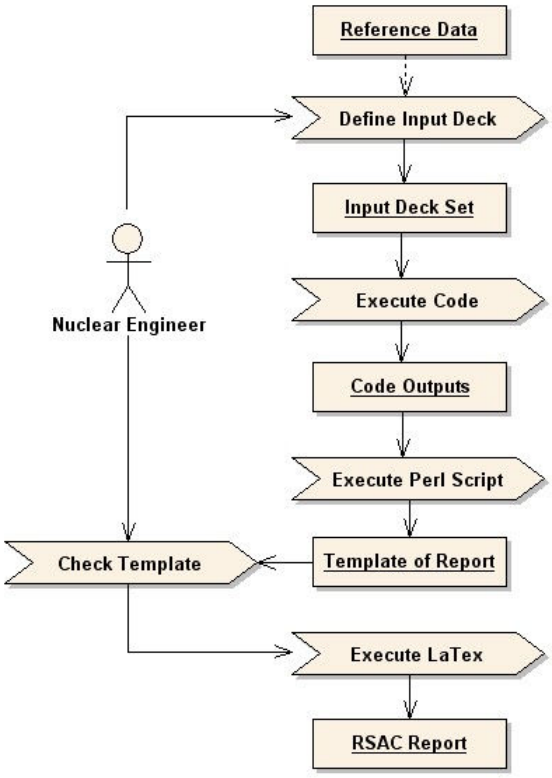

Figure 1. Overview data flow of the system. The engineer only needs to define input decks, check templates, input opinions.

2.3 Output control and Generation of Report

[*] The system use script language and the language tool is "ActviePerl", for more information, reference http://www. Activestate.com.

After downloading code outputs from the server, the templates for the report are generated by the editing scripts and Latex † embedded in Safety Analysis Automation System. By the clicking of "calculation note generation" button after overall data checking, reload designer can get selected calculation notes within a couple of minutes.

Figure 2. The list of Safety Analysis Calculation Notes.

3. Conclusion

By using of this system, reload core designer can save the time for handling scores of input and output files. The complex and well-organized scripts made this system so simple and efficient. This system is confirmed by a skilled nuclear engineer through the process of system development. The reload core designer can reduce time needed for RSAC calculations, and remove the possibility of human errors with this system. The advantage of using this system is, this system provides time efficient environment for Core Designer to verify more reload core patterns and support more safety verified LPs to plant.

REFERENCE

[1] Westinghouse Electric Company, METCOM, 2004
[2] Westinghouse Electric Company, Code System Manual (ALPHA, PHOENIX, ANC, APOLLO, CYCLE, JOB, etc.)

† LaTex is a kind of Tag for publication of PDF file, for more information, reference http://www.ktug.or.kr