

Integrated Validation System for a Thermal-hydraulic System Code, TASS/SMR-S

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1. Introduction

The Integrated Validation System (IVS) for the thermal-hydraulic system code, TASS/SMR-S (Transient And Setpoint Simulation/System-integrated Modular Reactor-Safety [1]) was developed. TASS/SMR-S can simulate thermal-hydraulic effect for SMART (System-integrated Modular Advanced Reactor [2]). Development including enhancement and modification of thermal-hydraulic system computer code is indispensable to a new reactor, SMART. Usually, a thermal-hydraulic system code validation is achieved by a comparison with the results of corresponding physical effect tests. In the reactor safety field, a similar concept, referred to as separate effect tests has been used for a long time [3]. But there are so many test data for comparison because a lot of separate effect tests and integral effect tests are required for a code validation. It is not easy to a code developer to validate a computer code whenever a code modification is occurred. IVS produces graphs which shown the comparison the code calculation results with the corresponding test results automatically.

2. Methods and Results

IVS has been developed in Microsoft Windows operation system in a personal computer platform. Three commercial software such as Origin, Microsoft Excel and Word, are introduced into IVS.

2.1 IVS Development

Origin is a popular software for a graph generation and supplies a programming language named LabTalk script for developers [4]. LabTalk is an interpreter language in order to develop Origin program. The on-line documents and forums for developers have been utilized helpfully [5-7]. The Origin supplies interface with Excel and Word as well. Excel is used for making an input file for IVS. On the other hand an output file is generated by Word. The created graphs by Origin are saved as a Word file for a review and report. All of IVS programs are run automatically using some batch file execution.

Excel file which has input information consists of columns such as, the test group folder name, case number, experimental and calculation data as shown in

Fig. 1. The data file (Fig. 2) is a text file which is written as spreadsheet style. The reference data type should be same with a calculated result because all graphs are generated by column basis.

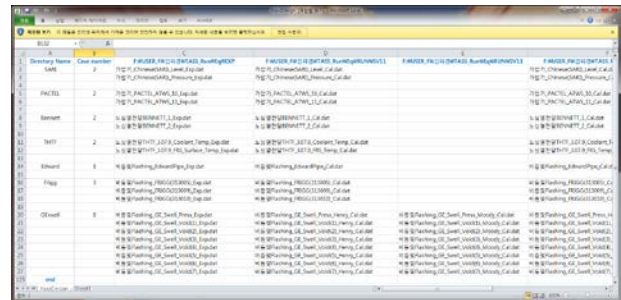


Fig. 1. The Excel input file has information of IVS execution such as test names and input file locations.

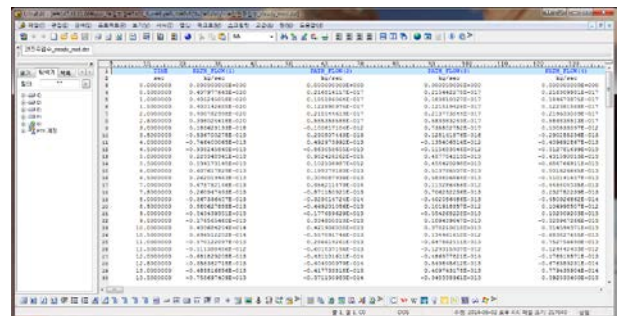


Fig. 2. There is a data heading on the first row. Usually 1st column is time. The other columns represent data like a pressure, temperature, flow rate, level, energy, power and other parameters for showing thermal-hydraulic phenomena.

The data file is imported to worksheet of Origin. All data including experimental ones should be arranged as spreadsheet style in order to compare each other. The number and type of variables for comparison should be same among comparable data. Experimental data should be a reference as 1st worksheet in Origin. From 2nd up to 5th worksheets can be filled with comparable data. Naturally the total column number and the type of corresponding columns should be same among worksheets for graph generation.

2.2 IVS run

The Origin script program can be run thru batch file execution. One reference file and several comparable

calculation files are imported to Origin worksheets as described in Excel input file. All corresponding columns in worksheets are drawn in a graph. The graph format is adapted as a designated template in an Origin script file. The calculated code version using the folder name in Excel input file and the other data information is also shown as a legend in a graph (Fig. 3). After creating all graphs, IVS put them into Word file and save it (Fig.4). Creating Word file is achieved by calling a small Origin C program in an Origin script file as shown in Fig.5.

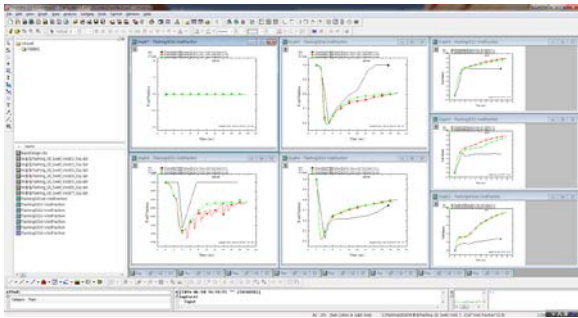


Fig. 3. The Origin project file is created by IVS. The format of graph can be easily changed using an Origin template if necessary.

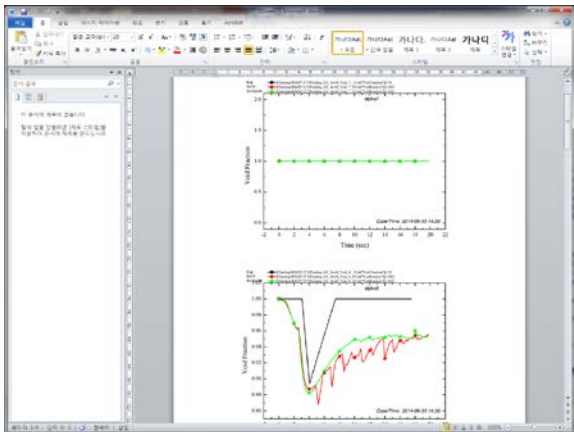


Fig. 4. IVS collects generated graphs in Word file, and this file can be utilized for the code validation report.

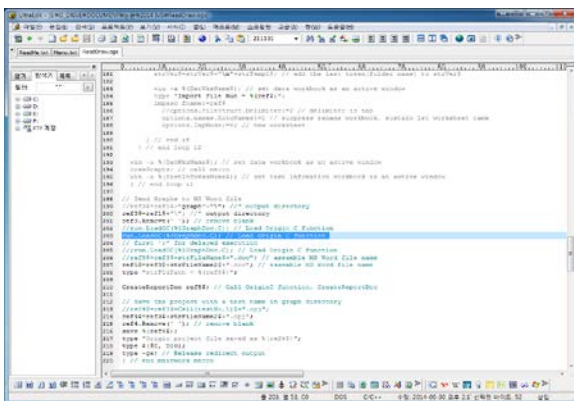


Fig. 5. Origin script is an interpreter style language.

2.3 IVS results

Several different type files are created by IVS run. The Word files contain all created graphs (Fig. 3). The user can check these files in order to validate the new code version. All Word files are saved under their test group named folder. The user can search all '.doc' files in all folders including sub-folders using a Windows explorer program. The Origin project file is also reserved for later use. The created graphs can be modified by user's intention using this Origin project file. All events during IVS run are described in a log file.

3. Conclusions

IVS was developed for a validation of TASS/SMR-S code. The code validation could be achieved by a comparison code calculation results with corresponding test results. This comparison was represented as a graph for convenience. IVS is useful before release a new code version. The code developer can validate code result easily using IVS. Even during code development, IVS could be used for validation of code modification. The code developer could gain a confidence about his code modification easily and fast and could be free from tedious and long validation work. The popular software introduced in IVS supplies better usability and portability. Even if the validation system is developed for a specific computer code such as TASS/SMR-S, it can be applicable to other code easily because general spreadsheet style input data format is used. IVS could be applicable to other software's validation with minor modifications.

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