

Validation of the Parallel Channel Test Loop Pressurizer Experiment Using the TASS/SMR Code

See-Darl Kim, Young-Jong Chung, Kyoo-Hwan Bae
SMART Reactor Design Division, KAERI, sdkim2@kaeri.re.kr

1. Introduction

TASS/SMR (Transient And Setpoint/Small and Medium Reactor) code [1] is a computer program developed for the performance and safety analysis of SMART (System-integrated Modular Advanced Reactor). Since the technologies used for the SMART design are different from the Convention loop-type reactors, the analytical capability of the TASS/SMR code has to be verified for its application to a safety analysis of SMART. Also the reliability of the analysis results of the code need to be verified using proper experimental data. In this paper, the PACTEL (**PARallel Channel TEst Loop**) pressurizer experiment problem was analyzed using the TASS/SMR code and the results were compared with the experiment data [2].

2. Methodology

The separate effect test of PACTEL pressurizer experiment is selected to validate the pressure prediction capability of TASS/SMR code.

2.1 PACTEL pressurizer experiment

Description of the test section

Figure 1 shows the schematic of the PACTEL pressurizer test. The pressurizer component of the PACTEL test facility is a steel container with the total height of 8.8 m and the inner diameter of 13.97 cm. The pressurizer is connected by the surge line with the Loop1 of the facility, and a spray line is installed on the top of the tank. The volume scaling ratio of the pressurizer, as well as the other components of the facility, is 1:205 and the elevation scale ratio is 1:1 compared to the reference reactor of the facility which is six loop VVER-440 type PWR.

Description of the ATWS-10-11

The objective of the experiments from ATWS-10 to ATWS-11 was to study steam compression under fast nearly isentropic compression. The procedure of the experiments was as follows. A 100s steady-state period was run with the heater power being 4kW. At 100s the heater was switched off and injection of nearly saturated water into the pressurizer using the high pressure piston pump began. A suitable core power was maintained to prevent the cooling of the facility. When the pressure reached 7.8MPa the injection to the pressurizer was stopped and draining began. A draining valve of 2mm in diameter was opened in the cold leg. The primary circuit and the other components of the facility were used only

to inject and drain water to and from the pressurizer. The test conditions of the experiments is given in Table 1.

2.2 TASS/SMR Code Input Modeling

The nodalization is shown in Figure 2. The total height is 8.8 m with an inner diameter of 0.1397 m. There are 7 nodes (1 pressurizer node), 5 paths and 2 valves. Table 1 shows the analysis condition.

Table 1 Test conditions of experiments

Test	Condition	Pressurizer	
		Initial	Final
ATWS-10	Pressure	5.9 MPa	7.6 MPa
	Water level	3.3 m	-
	Temperature	273.85°C	-
	Flow rate	0.367 kg/sec	-
ATWS-11	Pressure	5.9 MPa	7.6 MPa
	Water level	3.5 m	-
	Temperature	273.85°C	-
	Flow rate	0.217 kg/sec	-

3. Results

The transient calculation was carried out for 500 seconds using the TASS/SMR code. Comparisons were made between the measured and calculated pressure at the pressurizer as shown in Figures 3 & 4. As shown in the figures, the results of the TASS/SMR code are over estimated approximately 10% than the experimental data and TASS/SMR code was able to reproduce the pressure at the pressurizer.

4. Conclusions

TASS/SMR code has the evaluation capability of major phenomena that occur in the PACTEL pressurizer experiment.

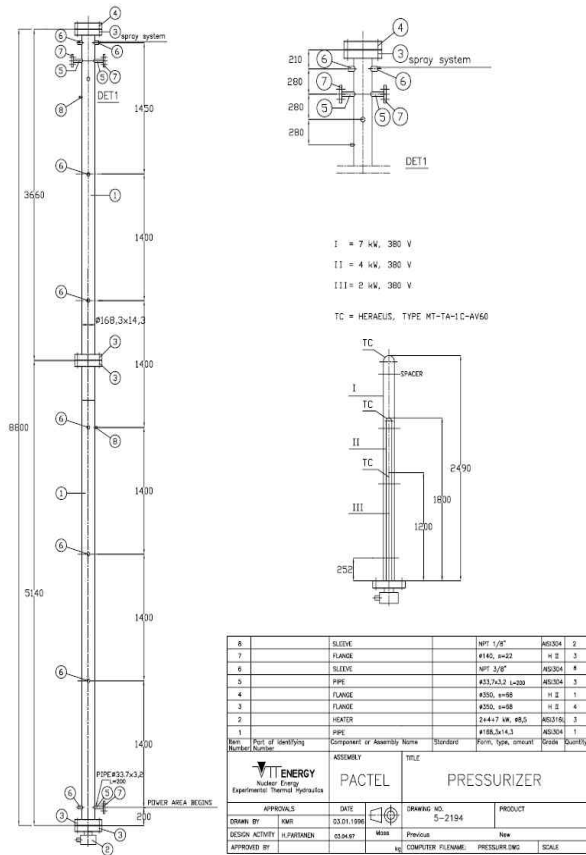


Figure 1 Schematic of the PACTEL pressurizer test

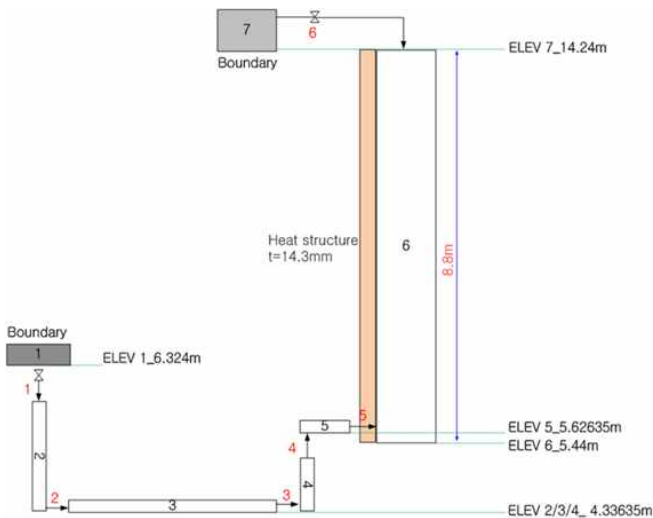


Figure 2 TASS/SMR nodalization for the PACTEL pressurizer test

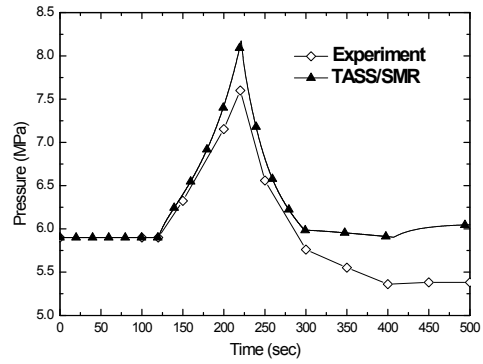


Figure 3 Comparison of the measured and calculated pressure at the Node 6 for ATWS-10

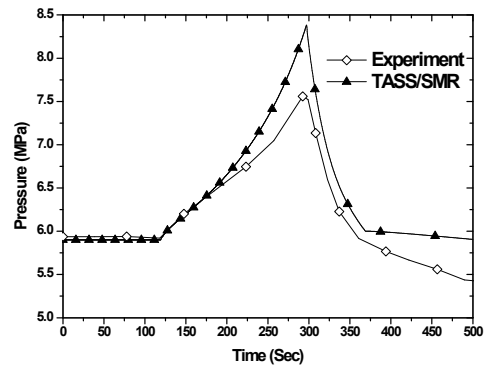


Figure 4 Comparison of the measured and calculated pressure at the Node 6 for ATWS-11

Acknowledgement

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- [1] S. H. Kim, "TASS/SMR-S Code Technical Report Vol. 1: Code Structure, Models, and Solution Methods", 911-TH464-001, Rev.2, KAERI, 2011.
- [2] Eveliina Takasuo, "Modeling of pressurizer using APROS and TRACE thermal hydraulic codes", Master thesis, Lappeenranta University, 2005.