Improvement and Evaluation for Henry-Fauske Critical Flow Model of SPACE code

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Introduction

☐ The Henry-Fauske critical flow model applied to the **SPACE code does not predict the break flow conservatively** compared to the critical flow model of the RELAP5 code

☐ The **break flow rate is one of the highly important phenomena** in accident analysis

☐ The **SPACE code applies a counter current flow limiting(CCFL)** model to compensate for the non-conservatism of these critical flows

☐ This causes a problem with **excessive calculation time**

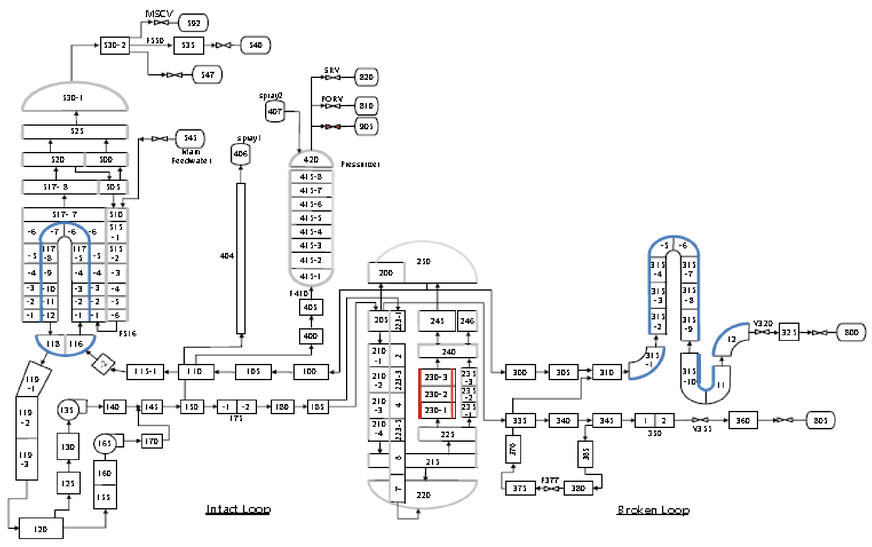
☐ To solve these problems, we add the **same Henry-Fauske critical flow model as RELAP5** to the SPACE code

☐ In this study, to verify this, **we perform verification evaluations on LOFT L9-3** which is a representative integral effect test(IET).

Analysis method

☐ The computer code used the SPACE 3.22

☐ LOFT L9-3 Modeling



☐ The LOFT L9-3 experiment purpose is to provide experimental data to developers of analysis codes for ATWS analysis, evaluate alternative methods of reaching long-term shoutdown without inserting control rods after ATWS, and verify the applicability of point kinetics model or transients

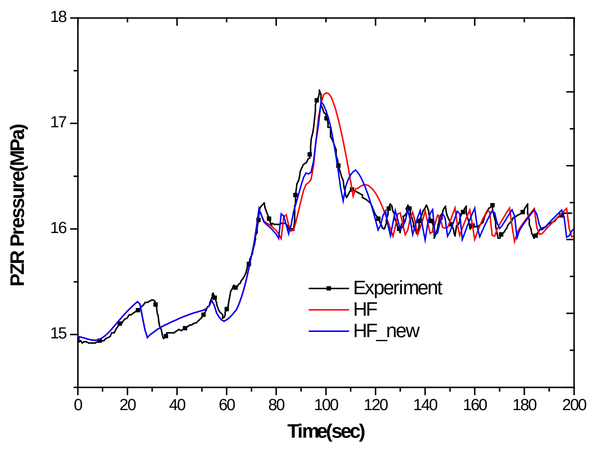
☐ In addition, the experiment data provided is used to determine the behavior characteristics of the primary system due to loss of main feedwater flow rate on the secondary side of the SG and to determine the two-phase and overcooling flow characteristics released through PORV and SRV at high pressure

☐ SPACE Steady State Analysis Results

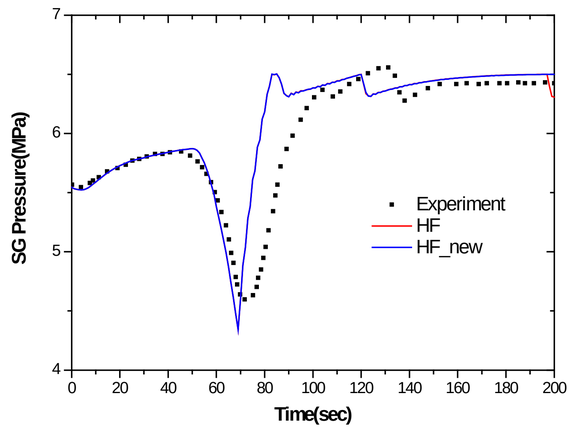
	Experiment	SPACE
Mass flow rate (kg/s)	467.6	467.63
Hot leg pressure (MPa)	14.98	14.95
Cold leg temperature (K)	557.0	555.04
Hot Leg temperature (K)	576.4	574.56
Power level (MW_t)	48.7	48.7
PZR Liquid temperature (K)	615.2	614.78
PZR Pressure (MPa)	14.98	14.98
SG Liquid level (m)	3.15	3.19
SG Pressure (MPa)	5.61	5.55
SG Mass flow rate (kg/s)	25.7	25.6

Analysis results

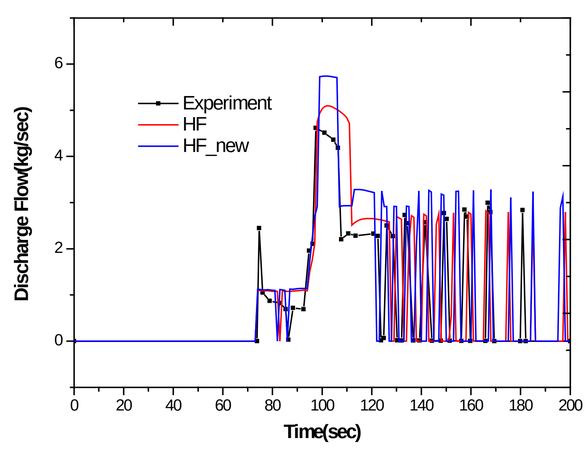
☐ Sequence of the Event



Pressure change of the pressurizer



Pressure change of the steam generator



Discharge flow rate

☐ An analysis of the Henry-Fauske critical flow model of existing SPACE code and the same conservative Henry-Fauske critical flow model as RELAP5 is performed on LOFT L9-3

☐ As a results, the conservative Henry-Fauske critical flow model was evaluative to conservatively predict the critical flow rate than the previous Henry-Fauske critical flow model

☐ A new Herny-Fauske critical flow model with RELAP5-level conservatism will be used in the future to develop SPACE methodologies for OPR1000-type and WH 3-loop type nuclear power plants