Comparison of MARS-KS to COBRA-TF for models and correlations in pre-CHF regime

Min-Gil Kim, Wonwoong Lee, and Jeong Ik Lee*
Department of Nuclear and Quantum Engineering
Korea Advanced Institute of Science and Technology (KAIST)
291 Daehak-ro, (373-1, Guseong-dong), Yuseong-gu, Daejeon 305-701, Republic of KOREA
gggggtt@kaist.ac.kr ; woong.aa@kaist.ac.kr ; jeongiklee@kaist.ac.kr

Young Seok Bang
Safety Evaluation Department
Korea Institute of Nuclear Safety (KINS)
62 Gwahak-ro, Yuseong-gu, Daejeon 305-338. Republic of KOREA
k164bys@kins.re.kr

ABSTRACT

To evaluate the safety of a Korean Nuclear Power Plant (NPP), one dimensional system analysis code, MARS-KS, is being used by the Korean regulator. The governing equations of MARS-KS are based on two-phase two-field model. MARS-KS code also includes COBRA-TF as well for sub-channel analysis of the reactor core. In contrast to MARS-KS, COBRA-TF is based on two-phase three-field governing equations. In this paper, the two phase flow regime map and correlations are compared between MARS-KS and COBRA-TF while considering the difference in the governing equations. This exercise is not only important for the basic understanding of the two phase flow modeling, but also it is important for the future Korean regulatory activity for assessing the appropriateness of SPACE (Safety and Performance Analysis CodE for nuclear power plants) developed by a consortium led by Korea Hydro & Nuclear Power Co., Ltd. (KHNP). The governing equations of SPACE are also based on two-phase (liquid and gas phase) three-field (continuous liquid, gas and droplet) governing equations like COBRA-TF. The effect of the implemented two phase flow regime map and correlations will be evaluated by modeling the selected separate effect test case with both MARS-KS and COBRA-TF and this will be followed by the discussion on the assessment results.

KEYWORDS
Two phase flow regime map, Correlation, two-phase flow, two-field model, three-field model

1. INTRODUCTION

To evaluate safety of a Korean Nuclear Power Plant (NPP) MARS-KS code is being used by the Korean regulator. The governing equations of MARS-KS are based on two-phase and two-fluid model. Recently, SPACE (Safety and Performance Analysis CodE for nuclear power plants) was developed by a consortium led by Korea Hydro & Nuclear Power Co., Ltd. (KHNP), which the code is aimed for evaluating the safety of the designed nuclear power plant. The governing equations of SPACE are based on two-phase (liquid and gas phase) three-fluid (continuous liquid, gas and droplet) model. However,

*Corresponding Author

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