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Use of Inverse Heat Conduction Solution for Determination of Temperature Distribution in the Pressurizer Surge Line

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Abstract

A prerequisite for reliable assessment of the thermal stratification impact on mechanical damage of pressurizer surge lines is to determine as accurately as the temperature distributions during transients where the highest temperature difference between pressurizer and hot leg occurs. In order to monitor the occurrence of thermal stratification in the pressurizer surge lines, various surge line outer surface temperature measurement programs have been widely implemented for pressurized water reactors. This paper presents a method to determine the temperature distributions of the inner pipe wall of pressurizer surge line from the circumferential temperature distributions measured on the outer surface of the piping by applying the inverse steady-state heat conduction solution. The steady-state inverse heat conduction solution is obtained using the boundary element method in conjunction with regularization procedure. The present method is validated by comparing the predicted results of a sample problem to the finite volume analysis results of fluid flow and heat transfer.