# Eulerian two-phase Computational Fluid Dynamics for boiling water reactor cor analysis

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Traditionally, the analysis of two-phase boiling flows has relied on experimentally-derived correlations as the bases of the analysis. While this approach provides accurate predictions of channel-averaged temperatures and void fractions and even peak assembly temperatures within an assembly, it lacks the resolution needed to predict the detailed intra-channel distributions of temperature, void fraction and steaming rates that are needed to address the fuel reliability concerns which result from longer refueling cycles and higher burnup fuels, particularly for the prediction of potential fuel pin cladding failures resulting from growth of tenacious crud.
As part of the ongoing effort to develop a high-fidelity, full-core, pin-by-pin, fully-coupled neutronic and thermal hydraulic simulation package for reactor core analysis , capabilities for Eulerian-Eulerian two-phase simulation within the commercial Computational Fluid Dynamics code Star-CD are being extended and validated for application to Boiling Water Reactor (BWR) cores. The extension of the existing capability includes the development of wall heat partitioning and bubble growth models, implementation of a topology map based approach that provides the necessary capability to switch between the liquid and vapor as the continuous phase on a cell-by-cell basis and the development of appropriate models for the inter-phase forces that influence the movement of bubbles and droplets.
Two applications have been identified as an initial demonstration and validation of the implemented methodology. First, the model is being applied to an Atrium-10 fuel assembly from Cycle 11 of the River Bend Nuclear Power Plant. Second, the model is being applied to an international benchmark problem for validation of BWR assembly analysis methods.

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