Comparison of 2D model and 3D model with periodic boundary condition

Comparison of 2D model and 3D model with periodic boundary condition using k-epsilon realizable solver

Hypothesis and Goals

Periodic boundary condition was applied to both side walls of the flocculation tank, imposing transitional repeating pattern of flow across the z direction in 3D model and zero pressure gradient. Thus all the results from 2D model are expected to be duplicated in the x-y plane in this 3D model with periodic boundary condition.

This is part of the preliminary simulation experiments extending the current 2D models into 3D, providing an intuitive illustration of the underlying simplifications of 2D models.

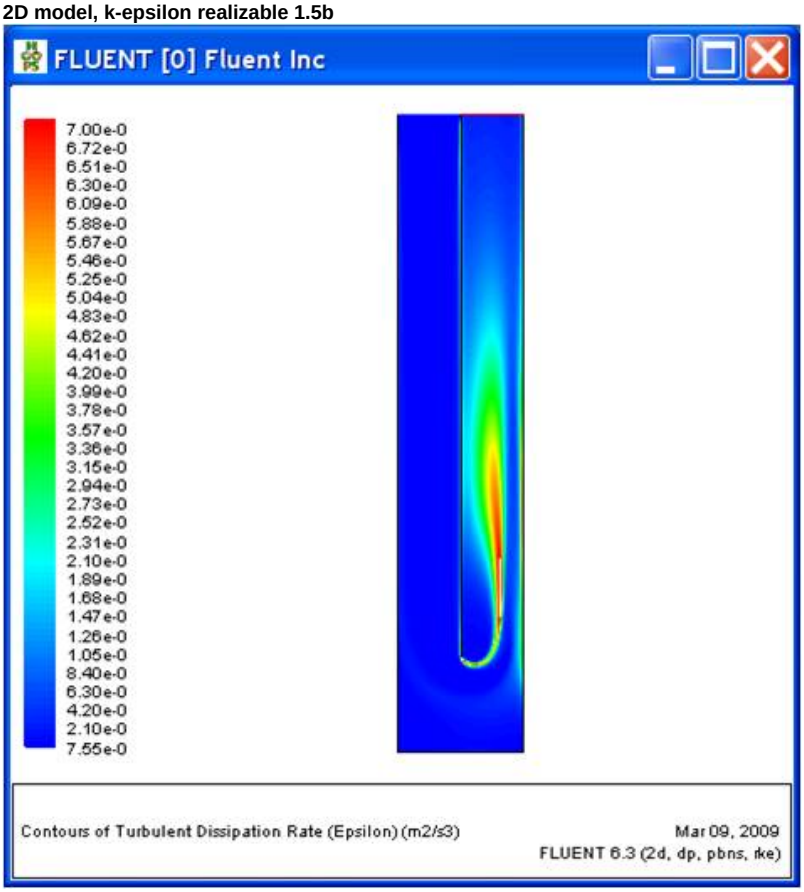
Methods and Procedures

Periodic boundary condition needs to be defined in text command interface as opposed to other common boundary conditions. Click here for a detailed description of each step, and here for the report summary containing all modeling parameters.

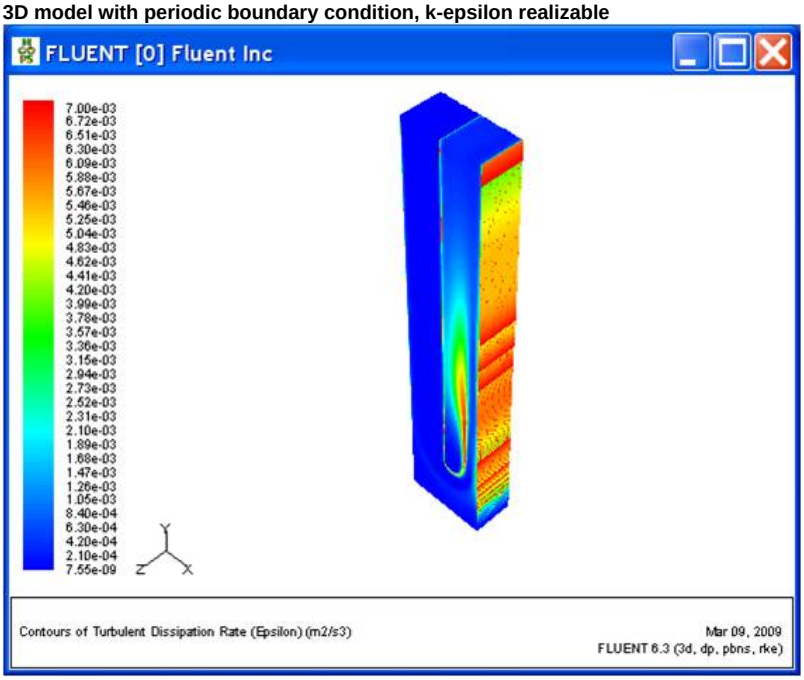
Results and Discussion

The results from 2D model was successfully duplicated in x-y plane of the 3D model with periodic boundary conditions. A comparison of the energy dissipation contours is shown below.

Energy dissipation contour of 2D model, k-epsilon realizable 1.5b



Energy dissipation contour of 3D model with periodic boundary condition, k-epsilon realizable



Since there is no variation in the z-direction in 3D model, the results from 2D is completely duplicated, which agrees with the underlying simplification of 2D simulation.

An important lesson

In FLUENT, the material property, in this case water liquid should be defined in the boundary conditions as well as in the material list. The default material in FLUENT is always air, which need to be checked and modified correctly before every simulation.

Report summary is a very good way to keep track of all the parameter settings. And more effective and efficient way of data management is necessary for carry out simulation experiments efficiently.