CFD2000 5.7.5 (a pre-annual release) provides the ability to generate compound BC "objects" that can be used in subsequently developed CFD models. This functionality greatly reduces the required CFD model generation effort for complex applications (consisting of repetitive geometric/physical features). In addition, object variants can be easily generated and incorporated into a CFD model application.

This document provides a guideline on the procedure for creating and utilizing compound BC objects. An example CFD application is also presented.

Object Creation

The procedure for creating an "object" follows the same methodology as creating any CFD model in CFD2000. However, there are required steps/aspects of the object creation process that must be followed:

- the mesh of an object must conform to the mesh in the destination CFD model
- the same flow specification settings must be used (e.g., turbulence, HT, VOF, etc.)
- objects should be located in the working directory as the destination CFD model

Once a CFD object model with the desired boundary conditions (BCs) has been created, it can then be saved as an object. This is accomplished by selecting the **File Menu** located on the top menu bar, and then selecting the **Save as Object** … menu item. The **SaveAs CFD2000 Object** dialog window will appear allowing the naming of the object (with a ".obs" extension).
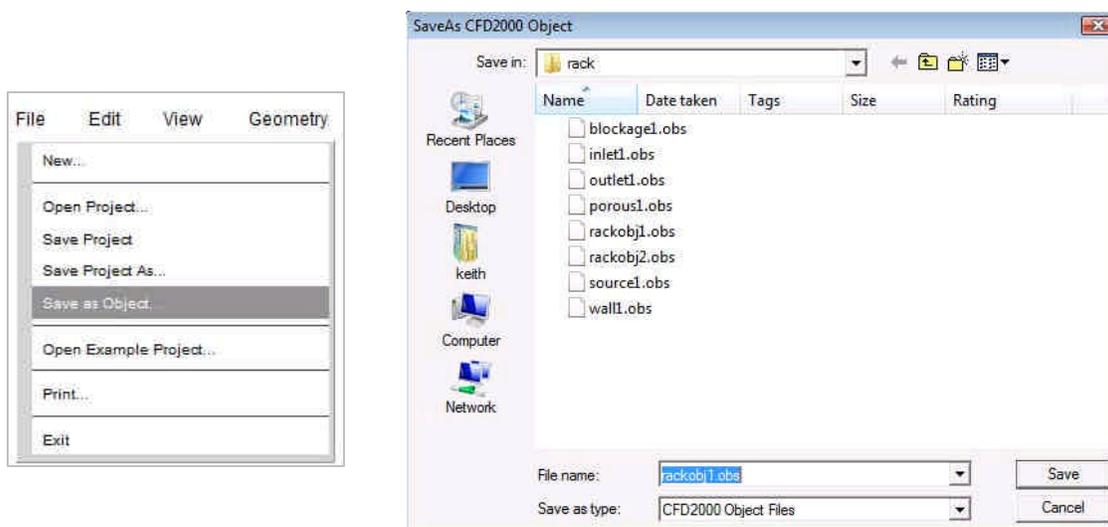
Example Object – Single Computer Rack

To illustrate the object creation process, a simple computer rack is created. The model definition is as follows:

Rack dimensions: 2 ft X by 6 ft Y by 2 ft Z
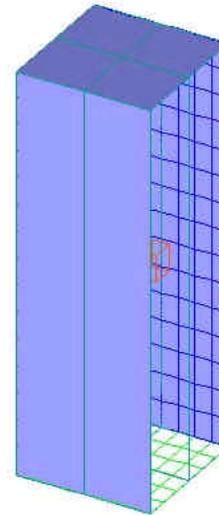
Mesh distribution: 8 I x 15 J x 6 K

3 wall BCs

1 inlet BC

1 outlet BC

1 heat source BC

Heat transfer and turbulence activated

Example CFD Model Using Objects – Computer Server Room

To illustrate the utilization of objects in a CFD model, a simple computer server room is generated consisting of 6 placed "rack" objects. The model definition is as follows:

Room dimensions: 28 ft X by 13 ft Y by 21 ft Z

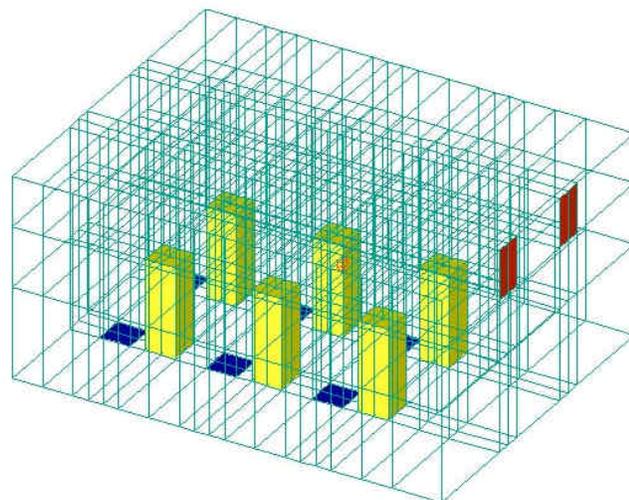Mesh distribution: 94 I x 31 J x 36 K

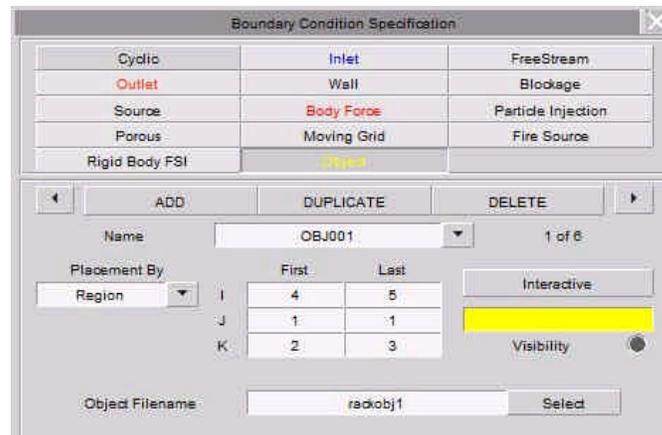6 inlet BCs (on floor)

2 outlet BCs

6 object BCs (rackobj1.obs file)

1 gravity BC (bousinesq)

Heat transfer and turbulence activated

The object BC creation process follows the same methodology as all boundary conditions. To create an object, select the **Object** button on the Boundary Condition Specification panel.

Object BCs can be placed either by region or by cell. Once an object location has been specified, it will be highlighted with the color yellow. To associate a previously generated object (with a ".obs" extension), click the Select button and choose the appropriate file located in the current working directory.
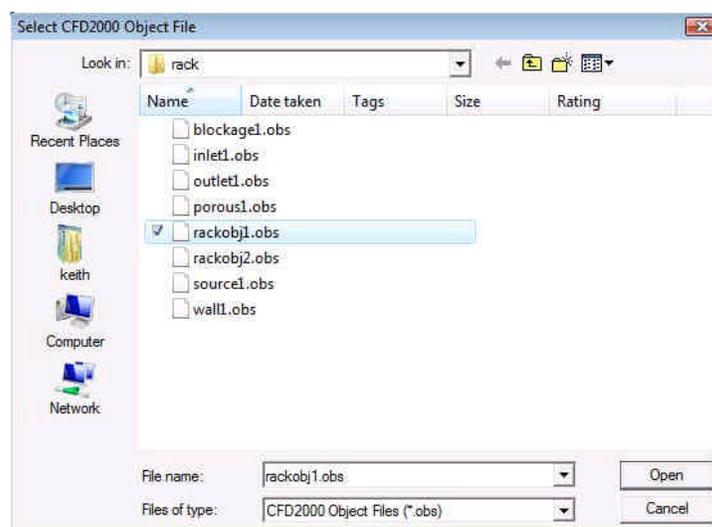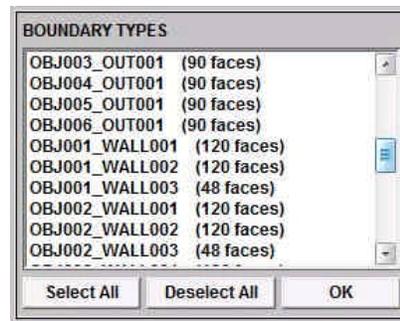

Executing the CFD Model

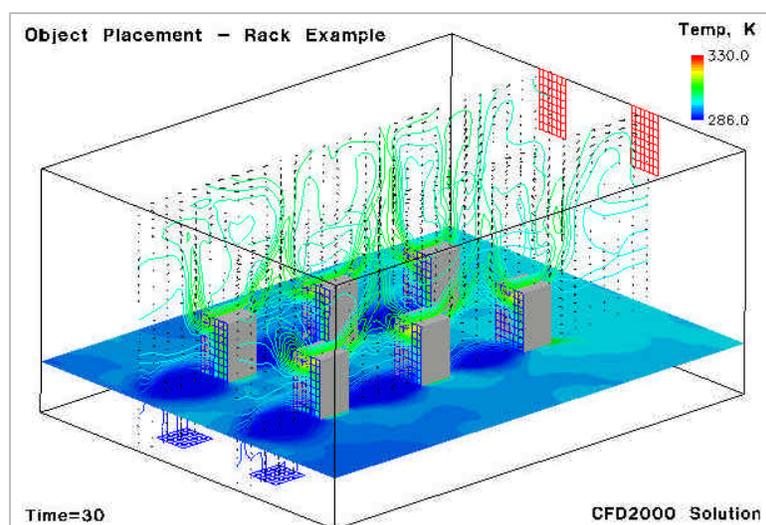The CFD model can be immediately executed by clicking the STORM execution icon located on the top toolbar:

After executing the CFD model containing object BCs, the generated solution visualization files ("*.svu") will contain boundaries with the following nomenclature:
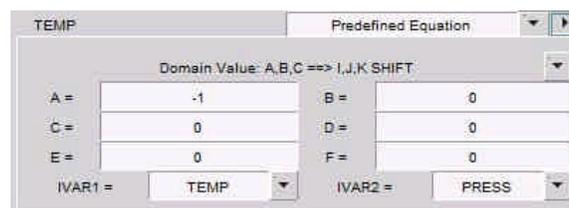
<object>_<boundary> (example: OBJ001_WALL001)

Simulation Result – Computer Server Room

Creating Object Variants

Note that the previous CFD model did not require any STORM solver customization. The Inlet BC for the rack object (rackobj1.obs) utilized a pre-defined function for temperature specification.

This pre-defined BC function sets the inlet BC value for temperature to the computational domain value one cell before the inlet location (accomplished with the -1 shift for the A constant).

A second CFD object (rackobj2.obs) has been created with a newly added pre-defined BC function that allows for the addition of a scalar variable constant. The scalar variable constant amount can also be controlled with two time parameters using the E and F constants provided.
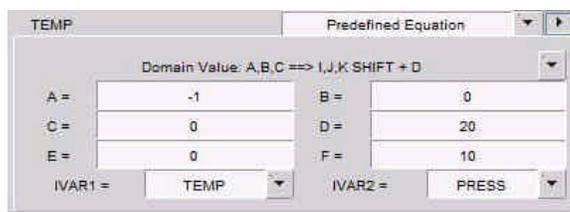

In this example, since IVAR1 is set to TEMP the D constant represents a 20 degree increase in temperature (K). The constant temperature addition can be controlled using the E and F constants as follows:

- If E and F are set to 0.0, then D is added for all time-steps of the simulation
- If F is set to a positive number, then the constant addition is added with a linear increase from time E to time F.

The final CFD model "rackobjb" utilizes both rack objects "rackobj1" and "rackobj2". "rackobj1" is applied to objects 1-3, and "rackobj2" is applied to objects 4-6 (the closer racks in the image below).

Simulation Result – Computer Server Room (with rackobj2.obs variant)
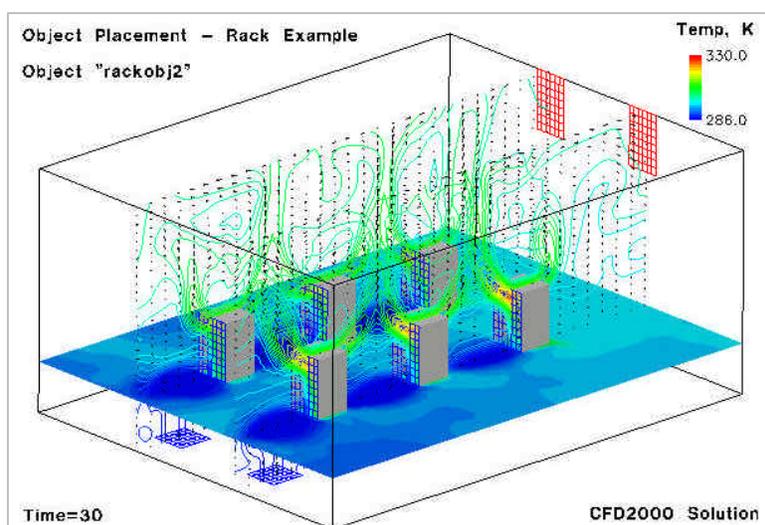
There is a noticeable higher temperature at the top of each rack for objects 4-6 (using "rackobj2") compared to each rack for objects 1-3 (using "racobj1"). This difference can also be seen when compared to the simulation solution presented on page 4.