Release Notes for RELAP5-3D Version 4.4.2

Code Improvements from Version 4.3.4

The following is a brief description of improvements and new features in version 4.4.2. The associated material in the User Manuals is shown as an underline.

Consistent fluid implementation for H2ON

Optional weighting factor, ω, used with H2ON only for averaging fluid properties and their derivatives between the original analytical calculations from Volume I, Equations (3.2-5) through (3.2-8) and linear interpolants on the grid points of the fluid property file. The analytical form corresponds to $\omega = 1.0$, the pure linear form corresponds to $\omega = 0.0$. For $0.0 < \omega < 1.0$, a weighted average of the two forms is applied. The value $\omega = 1.0$ is applied for all other fluids and is the default for H2ON.

Special value -1.0 is a flag that indicates that weighting varies from the smaller pressure grid point with value 1.0 to the center with value 0.0 and back to the larger pressure grid point with value 1.0. Often, either $\omega = 0.0$ or $\omega = -1.0$ gives lower mass error than the default value, but it is not always the case.

The weighting factor is accessed with Word 6 of the 120-129 Cards.

<u>See Vol. 2, Appendix A, Section 2.</u>

Added H2O95N fluid

A hybrid fluid property table based on the NBS/NRC Steam Tables from 1984 (H2ON) and the NIST/ASME Steam Tables from 1995 (H2O95) called H2O95N was developed. H2O95N has independent parameters PU and extends into the metastable regions similar to the H2ON tables. This new fluid can be accessed by entering ‘h2o95n’ in Word 3 of the 120-129 Cards.

See Vol. 2, Appendix A, Section 2.

Timing updates

Updates were added to the code to allow the user to run timing studies on a Linux platform or via a Linux emulator with the C-shell or TSCH available. This timing capability is accessed by supplying the fourth argument, timing, when running the installation dinstls script. It can be run at any time by activating the “dotiming” script from the Timer subdirectory of the run directory,

LiPb transport properties updated

The transport properties for fluid LiPb were updated to more closely match experimental data.

Jetmixer fixes

Errors were found in the jetmixer component for reverse flow situations. The component was updated for these scenarios.

Card 1 Option 29 made default coding

The coding implemented when using Card 1 Option 29 is now the default coding. The previously default coding can still be accessed using Card 1 Option 56. If Card 1 Option 29 is used an input error occurs.

Improved allocation and deallocation of many variables

Some arrays were found to be allocated/deallocated incorrectly. This caused memory leaks in multi-case problems. Similarly some pointers were not properly nullified. These issues were corrected.

Updates for Groeneveld 2006 CHF correlation

Some of the k-factors were found to be incorrect and were changed to match the documentation for the correlation.

CCFL model corrections

The CCFL model did required input modification when the abrupt area change model and the input area at the junction is less than the minimum of the two adjacent volumes. The user needed to modify the input constant C for the flooding equation to obtain the proper junction velocity. The coding was modified so that the correct junction velocity would be calculated for these conditions.

The CCFL was sensitive to the time step size used. To obtain meaningful results the user would need to run at a reduced time step size. The issue was found to be due to the CCFL test being performed based on an intermediate junction velocity. The coding was modified to calculate this test based on the junction velocity at the previous time step. After making this change the time step sensitivity was resolved.

Gnielinski heat transfer correlation fix for pure air

The Gnielinski heat transfer correlation was not being evaluated correctly for pure air (noncondensable). This correlation was corrected for pure air.

Numerous other user problems solved