Progress on RELAP5-3D User Problems

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Users experience difficulties with RELAP5-3D and submit User Trouble Reports. Some of these are described, along with their resolutions.

Introduction

After a review of recent work on user problems, three problems of great interest that present especial complexity in finding a solution are presented here. The description and solutions are presented.

RELAP5-3D User Problems

1. USER PROBLEM 17014 reported 5/17

TYPE: Code execution failure

TITLE: Jetpump reverse flow TH property error

DESCRIPTION: A user group reported a thermodynamic property failure with the jetmixer model. In a LOCA event when there is reverse flow through the jetmixer, the code fails as the vapor internal energy in the jetmixer exceeds the steam property table. This error occurs in both versions 2.4.1 and 4.0.3. In addition to finding the cause of the flow excursion, there is likely at least one other open question. There is significant recirculating flow through the drive line of the jetmixer before the flow excursion begins. This may be numerically induced.

STATUS: RESOLVED (CBD): The original coding always calculated the mass flow rates using the volume fraction and density from the K volume, which is the upstream volume for normal flow in the jet mixer. The revised coding now calculates the mass flow rates using the donored junction properties. The revised coding is more accurate in that it accounts for flow reversals and countercurrent flow. There was also an error in calculating the loss coefficient in the event of flow reversal that was corrected. The problem then was able to run successfully with meaningful results.

2. USER PROBLEM 17019 reported 8/17

TYPE: Unphysical result

TITLE: Error with the Gnielinski heat transfer correlation

DESCRIPTION: The Gnielinski heat transfer correlation is not being evaluated correctly for heat transfer to pure air. The current logic in gniel.F calculates a wall correction factor based on the ratio of the wall to bulk temperatures when the heat transfer mode number is 9 (single-phase gas). However, for heat transfer to a pure noncondensable, the mode number is 0 and the wall correction factor is not based on the temperature ratio, but is based on the liquid Prandtl number ratio, which was initialized to zero and never updated. As a result, the turbulent heat transfer coefficient from Gnielinski is set to 0.0 when the mode is 0, and the code selects either the laminar or natural convection values.

STATUS: RESOLVED (CBD): The wall correction factor is updated to be based on the temperature ratio and the problem is resolved.

3. USER PROBLEM 17026 reported 11/17

TYPE: Restart/Renodalization failure

TITLE: Multicase restart failure

DESCRIPTION: The verification input deck multicase.i has a restart input deck, multirest.r.i that fails with a core dump on a case after the first one. This failure has been observed to occur on the second and fourth case depending on which restart record is used for restart

STATUS: RESOLVED (NAA): Was able to get the problem to run by changing the plot file format to mbinary. The problem now runs to completion. Saw various verification file differences which were primarily associated with issues in the input deck. Modified the input deck and now observing differences in the neutron fluxes only. The difference first occurs in the first time-step after time=10.0 sec. The base deck takes a smaller time-step than the restart deck. Found that the base deck does not increase the time-step size until the 2^{nd} step after the new time card. This resulted in the observed differences. The difference occurs because of an if test in the internal subroutine doubleDt in dtstep.F. Modified the if test to check if it should double the time-step size when the variable last is true (which indicates that the code is executing the last step of a time card) and when the new dtmax is greater than af*dt. Tested the entire verification test set and all the problems passed both with and without PVM.