PYGMALION in RELAP5-3D

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Pygi modifications to support newer RELAP5-3D code versions

PYGMALION is a RELAP5-3D user aid program developed at the INL to transfer updated initial conditions from the restart-plot file to a copy of the original input file. Pygi (its nickname) was designed to work with the combined restart-plot files generated by RELAP5/MOD1 through RELAP5/MOD3 and all versions of RELAP5-3D older than 2.9.2. To continue providing this functionality to the RELAP5 community, the program has been upgraded to support the newer versions of RELAP5-3D while continuing its support of older versions.

There are numerous reasons to create a new input file with updated initial conditions, rather than simply restarting from a restart file. The restart file is generally much larger than the updated input file and requires the use of a second file, namely the input-for-restart file. For the user, it is easier and more convenient to maintain a single input file that already incorporates updated initial conditions. Further, using a restart-plot file to another computer is impossible unless the machines are binary compatible. With the ever-developing nature of computer hardware, machine dependent formats guarantee obsolescence of the data at some future time. Finally, updates to the RELAP5-3D code may introduce incompatibilities that prevent reading a restart-plot file generated by a previous code version. It was for these reasons that Pygi was created.

The Pygi utility program obtains initial conditions from the plot records in the restart-plot file generated when an input file is used by RELAP5 to run a transient or steady-state. Pygi accesses the plot-records, obtains the final conditions for each component of the system model, and replaces the appropriate cards in a copy of the original input file with cards containing the new conditions. The new input file then accurately represents the hydrodynamic state of the problem as it was at the end of the steady-state initialization run. Although it is typically used to create decks with steady-state initial conditions, it can also replace the initial conditions with conditions from any plot time from a transient calculation.

For RELAP5-3D prior to version 2.9.2, plot data is stored in the plot records of the restart-plot file. For subsequent versions, the plot records are stored only in the plot file and must be obtained therefrom by Pygi. Further, the restart-plot file is written in machine-dependent binary only. The plot file can be written in the user's choice of three formats. The previous PYGI functionality has been retained and a new command line flag (-F fmt) has been added to allow the user to specify the plot data file format. Therefore, supported formatted files include:

        (1) Machine-dependent binary PLOT FILE

        (2) XDR (eXtended Data Representation) machine-<u>in</u>dependent binary PLOT FILE

        (3) ASCII machine independent PLOT FILE

        (4) Machine-dependent binary RESTART-FILE

The PYGMALION manual has been updated to reflect these changes. Further usage information for the program may be found within. The manual is available from INL.

Pygi has not been through a formal verification and validation process. Therefore, the user must verify that Pygi has correctly transferred the final conditions to the input file. This verification can be accomplished by running a null transient, in which all boundary conditions are held constant, with the updated input file. If the hydrodynamic conditions remain steady during the null transient, Pygi has been successfully used to generate a steady-state input deck. If the hydrodynamic conditions are not acceptably steady, Pygi can be used again or transients can be initiated with restarts. The use of Pygi is more convenient, but restarts are more accurate for some cases. Engineering judgment is required to determine what is acceptably steady. or vice-versa.

Future work with Pygi could involve incorporation of new plot-file formats, such as CSV (Comma Separated Values), and the elimination of options for RELAP5/MOD1 which itself is no longer supported.